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THE LONDON NATURALIST

the journal of the
LONDON NATURAL HISTORY SOCIETY

No 56

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LONDON NATURAL HISTORY SOCIETY

WHATEVER your interest in natural history—beginner or expert—the Society will welcome you as a member. You are offered a wonderful opportunity of extending your knowledge and increasing your enjoyment. The Society's Area lies within a 32 km (20-mile) radius of St Paul's and here most of its activities take place. Although so much of the area is covered with bricks and mortar it is a most exciting region with an astonishing variety of fauna and flora. The Society consists of sections whose meetings are open to all members without formality. If you are interested in archaeology, botany, ecology, entomology, geology, mammalogy, ornithology, rambling, or if you are a young naturalist, there is a section ready to help you.

INDOOR MEETINGS

These are held in most weeks throughout the year with films, colour slides, lectures and discussions on all aspects of natural history.

FIELD MEETINGS

Led by experts to visit interesting natural history localities, many outside our Area. These excursions are very popular with beginners wishing to increase their knowledge and enable members to get to know one another.

PUBLICATIONS

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area, including records of plants and animals.

The London Bird Report, published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins, including the *London Natural History Society Newsletter* and the *Ornithological Bulletin* are sent to members throughout the year.

LIBRARY

A large selection of books and journals on most aspects of natural history is available to members free of charge.

READING CIRCLES

Many important natural history journals are circulated by the sections at a fraction of the cost of subscribing direct.

MEMBERSHIP AND SUBSCRIPTIONS

ORDINARY MEMBERS	.	.	.	.	£4.00
JUNIOR MEMBERS	.	.	.	.	£2.00
FAMILY MEMBERS	.	.	.	.	£2.00

The entrance fee is £0.50. Junior membership is for persons under 18, or under 25 if receiving full-time education.

All except family members receive one free copy of *The London Naturalist* and *The London Bird Report* each year.

Further details may be obtained from:

The Membership Secretary, Mrs B. F. Barrett,
21 Green Way,
Frinton-on-Sea, Essex, CO13 9AL

THE LONDON NATURALIST

Back numbers of *The London Naturalist* are available as follows:

No. 39 (1960) — 47 (1968); 49 (1970) — 52 (1973): £1 each post free. No. 48 (1969): £0.50 post free. No. 53 (1974) — 54 (1975): £1.50 post free. No. 55 (1976) — 56 (1977): £2.50 post free.

These, and back numbers of *The London Bird Report*, may be obtained from the Publication Sales Secretary, Mrs H. M. Housego, 110 Meadvale Road, Perivale, London, W5 1LR. Reprints of the Index to *The London Naturalist* 32-51 are available for £0.25 post free. Reprints of the *Annual Rainfall Overlay*, *Master Grid Overlay*, *Habitat Overlay* and *Regolith Overlay* are £0.10 each post free.

North London Natural History Society.

RULES.

Name of Society.

1. The Society shall be called the "NORTH LONDON NATURAL HISTORY SOCIETY," and shall have for its object the study and diffusion of Natural History.

Subscription.

2. The Entrance Fee shall be Two Shillings and Sixpence and the Minimum Subscription Five Shillings per annum, payable on election and in advance at the Annual Business Meeting in each year; but any Member elected after June 30th may pay a Subscription of Two Shillings and Sixpence for the year of his election. A former Member of the Society upon re-election shall not be required to pay an entrance fee.

3. The composition for Life Membership shall be Two Pounds Ten Shillings.

Election of Members.

4. Every candidate for membership shall be nominated in writing by two members of the Society, to one of whom the candidate must be personally known. The nomination shall be sent to the Secretary, who shall read the same at the two succeeding ordinary meetings. The candidate shall then be eligible for election by ballot at the next ordinary meeting, one adverse vote in five excluding.

Associates.

5. Persons residing outside London shall be eligible to become Associates of the Society.

6. The Subscription for Associates shall be Two Shillings and Sixpence per annum.

7. Applications for associateship shall be made to the Council on a form provided for the purpose.

8. Associates shall be entitled to the same privileges as ordinary members, excepting only that they shall not vote on matters connected with the business of the Society.

Honorary Members.

9. The Council shall have power to nominate Honorary members, who shall be eligible for election according to Rule 4. The Council shall have power to remove from the list the name of an honorary member, when it has ascertained from him that he no longer desires to retain his connection with the Society.

10. Honorary members shall not be eligible to hold any office in the Society; but in all other respects shall enjoy the same rights and privileges as ordinary members, and shall be subject to the same rules, except that they shall not be required to pay the entrance fee and annual subscription.

11. Any honorary member may elect at any time to become an ordinary member by merely paying the annual subscription.

Resignation of Members.

12. No member shall be expelled from the Society, nor shall any member of the Council be removed from office, except at a General Meeting of the Society. Every member shall receive at least three days' notice that the proposal to expel will be brought forward at such meeting. For this purpose, the member making the proposal shall give ten days' notice of his intention to the Secretary.

13. Whenever the subscription of any member shall be nine months in arrear, written notice shall be sent him by the Treasurer; if, after a further period of three months the subscription be still

unpaid, the Council shall have power to erase such member's name from the books of the Society, after written notice has been sent him by the Treasurer.

14. Any member wishing to resign shall send written notice to the Secretary to that effect.

**Officers and
Council.—
Election and
Powers.**

15. The Officers of the Society shall be a President, two Vice-Presidents, Treasurer, two Secretaries, Librarian, two Curators, and a President of the Research Section (subject to Rule 16*b*, or as the case may be).

16. The business of the Society shall be conducted by a Council, consisting of the Officers and four other members—five to form a quorum. The members of the Council shall be elected annually, by ballot, at the first ordinary meeting in December (which shall be the Annual Business Meeting), the candidates being nominated at the preceding ordinary meeting. The council shall have power to fill any vacancy occurring during its term of office.

17. The Council shall annually select two of their number who shall be ineligible for re-election for the space of one year, unless appointed officers of the Society.

18. The Council shall have power, without the formalities attendant upon an alteration of rule, from time to time as need in their opinion shall arise, to make orders appointing additional Curators, and such additional curators shall thereupon immediately be officers of the Society within the meaning of Rule 16. The Council shall also have power under this rule to separate the Society's Curatorships so as to make each Curatorship a separate office if need be. All orders and appointments under this rule shall be announced at the next general meeting of the Society after they shall have been made, and thereupon such Orders shall be deemed to be incorporated in these rules, and Rule 15 shall be deemed to read as if the number of Curators therein mentioned were altered so as to comprise such additional appointments, but these rules shall not otherwise be altered.

19. The Treasurer, Librarian and Curators may each, in case of absence, appoint a deputy, subject to the approval of the President. Such deputy shall have, for the time being, all the authority and privileges of his principal in his department, and shall represent him on the Council.

20. The Council shall have power to regulate its own procedure, subject to these rules.

21. The Council shall have power to make any regulations concerning the conduct of the Society generally, subject to Rule 39, provided the same do not directly or indirectly contravene any of these rules.

**Ordinary
Meetings.**

22. The Society shall in general hold ordinary meetings twice a month, at such time and place as the Council shall appoint; but the Council shall have full power to eliminate any meeting, or call any special meeting. Informal meetings shall be entirely in the discretion of the Council.

23. The procedure at the Society's ordinary meetings shall in general be as follows :—

- (a) The minutes of the previous meeting shall be read, and, when confirmed, signed by the Chairman.
- (b) Donations to the library or collections announced.
- (c) Exhibits and short communications on any branch of Natural History.
- (d) Official business.
- (e) Paper, discussion, or other special business appointed for the evening.

The Chairman shall have power to vary the procedure of any particular meeting. If any resolution or other business, not affecting the Constitution of the Society, be declared urgent by a majority of two-thirds of the members present in a meeting of not less than twenty members, the Chairman shall permit the discussion of such resolution or other business.

Duties of Officers.

24. The President shall preside at all meetings of the Society and Council, and shall direct the calling of the Council meetings, and sign the agenda sheets and other documents.

25. In case of inability on the part of the President, the calling of Council meetings shall be sanctioned, and agenda sheets and other documents signed, by one of the Vice-Presidents. If neither of these officers be available, the Secretary shall have power to call Council Meetings for urgent business on his own initiative.

26. In case of the absence of the President and Vice-Presidents at any meeting, or of their inability to take the Chair, the Chairman shall be elected by the members present.

27. The Chairman shall not be eligible to propose or second any motion, except votes of thanks, condolence and congratulation.

28. The Chairman shall have a casting vote, in addition to his vote as a member, and his decision on all questions of order shall be final.

29. The Treasurer shall collect and pay all moneys due to and from the Society, subject to the sanction of the Council, keep the Society's accounts, and submit the same to auditors and to the Finance Committee when required to do so.

30. The Secretaries shall keep a list of the names and addresses of the members of the Society, take minutes at all meetings, draw agenda sheets for approval and signature by the President, draft the syllabus, annual report and other official documents to be settled by the Council, and conduct the Society's correspondence under the direction of the Council.

31. The Librarian shall have charge of the library and of the official books of the Society, other than those in current use, keep a catalogue of the contents of the library, and superintend the borrowing of books by members. A copy of the regulations relating to the library shall be placed in each book.

32. The Curators shall have charge of the Society's collections and apparatus.

33. The President of the Research Section shall organise the research section of the Society's work, and shall conduct the Society's correspondence with its Associates.

34. The Treasurer, Secretaries, Librarian and Curators shall have power to make regulations concerning the departments under their control; but the Council may supervise such regulations, if it desires to do so.

35. The Treasurer, Librarian, Curators, and The President of the Research Section shall make an annual report to the Council on the departments under their control.

Audit.

36. At the meeting preceding the Society's Annual Business Meeting, two Members of the Society shall be elected by ballot (one from the Council and the other from the rest of the members) to audit the accounts of the Society, for the purpose of their being submitted to the Annual Business Meeting for adoption.

37. In case the office of Treasurer shall become vacant between two Annual Business Meetings the accounts shall be audited forthwith; but the auditors shall always be appointed at a meeting of the Society, and not by the Council.

Finance.

38. At their first meeting in every year the Council shall appoint a Finance Committee for the year (who shall continue in office until the appointment of their successors), consisting of Treasurer for the time being and two other members selected from their own body.

39. The duties of the Finance Committee shall be to prepare and issue financial statements for the Council when necessary, to decide upon any doubtful item and whether such item should be dealt with under the heading of capital or revenue and generally to advise the Council on all financial matters.

40. While the Society's balance, in cash or investment, as shown at the last annual audit, shall not exceed £30, no expenditure beyond the normal and ordinary expenditure for the year shall be sanctioned without the consent of a general meeting specially summoned for the purpose, which shall not be one of the ordinary meetings appearing on the Society's syllabus.

41. While the Society's balance, in cash or investments, as shown at the last annual audit shall exceed £30, but shall not exceed £100, no unusual expenditure shall be sanctioned except as in Rule 40, save that the outgoing Council for any year may appropriate a sum not exceeding two thirds of the balance of profit for that year to such expenditure as may seem to them necessary or advisable.

42. While the Society's balance, in cash or investments, as shown at the last annual audit, shall exceed £100, the outgoing Council for any one year may appropriate the whole of the balance of profit for that year to such expenditure as may seem to them necessary or advisable, but otherwise no unusual expenditure shall be sanctioned except as in Rule 40.

43. The decision as to what is unusual or normal and ordinary expenditure under the last three rules shall rest with the Finance Committee.

Privileges of Members.

44. Members of the Society shall be entitled to speak and vote at all meetings, except those of the Council, to have access to the library and collections, and to introduce visitors at the meetings.

45. Only members present at the Society's meetings shall be allowed to record their votes.

46. Visitors shall be allowed to speak or vote at formal meetings, only at the special invitation of the Chairman.

Appeals.

47. In case it be desirable, in the opinion of not less than 3 members, to amend any decision or regulation of the Council, or of any officer of the Society, such members may appeal to the Society, at a general meeting, for final decision. A signed notice of appeal, embodying their definite requirements, must be delivered to the Secretary, and the Council shall have power within one month to veto such appeal. If this veto be unwarrantable in the opinion of not less than five members, they may propose a motion of want of confidence in the Council, which shall be delivered to the Secretary in writing, not less than ten days, or more than one month, before the motion is to be discussed. The Secretary shall give every member seven days' notice of the exact terms of any motion coming before the Society.

Alteration of Rules.

48. No alteration of these Rules shall be made, except at a meeting of the Society, whereof every member shall have had at least three weeks' notice. For this purpose any three members desiring to propose an alteration must notify the Secretary of their intention, and the notification must contain (as must the Secretary's notice to the members) a clear statement of the exact terms of the proposed alteration under this rule.

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No. 56
for the year 1976

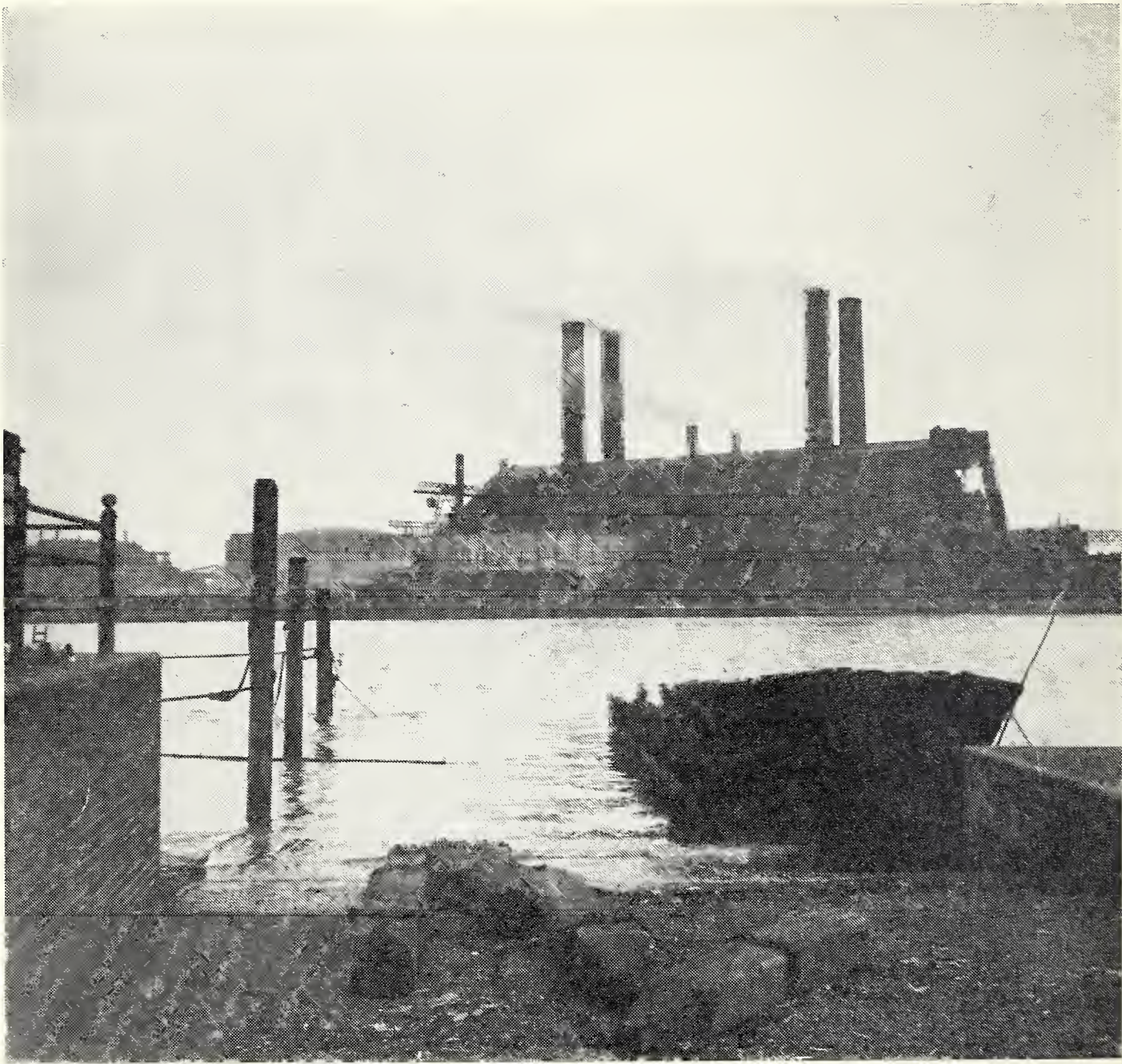
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with the assistance of
R. M. Burton and K. H. Hyatt

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The polluted River Thames of 20 years ago, as seen from Battersea church with Lots Road Power-station across the water. The clean-up of the Thames is the most successful conservation measure to have been implemented in the capital in recent years, and the papers on the flora and fauna of the river in this issue underline this outstanding achievement. Photograph: J. R. Laundon, April 1957.

LONDON NATURAL HISTORY SOCIETY

Founded 1858

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P. C. Holland

28 Hetherington Road, London SW4 7NU

Honorary Vice-presidents:

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Sub-editors, *The London Naturalist*: R. M. Burton, B.A. (Botany), K. H. Hyatt (Zoology).

Editor, *The London Bird Report*: K. C. Osborne, M.B.O.U., 8 Ellice Road, Oxted, Surrey RH8 0PY.

Editor, *London Natural History Society Newsletter*: P. J. Clement, 80 Coverts Road, Claygate, Esher, Surrey.

Elected Members of Council: D. Bowman, B.SC., Miss M. P. Brown, R. M. Burton, B.A., Miss E. M. Hillman, B.SC., P. J. Oliver, Miss J. M. Stoddart.

Representative Members of Council: Miss B. Allen (Geology & Archaeology), Miss M. L. Currie (Ecology), Miss R. M. Hadden (Botany), Miss A. McCord, M. Phil. (Nature Conservation), Miss H. M. Smith (South-west Middlesex), Mrs L. Turner (Ornithology), Miss D. E. Woods (Ramblers).

Report of the Society for 1976*

This, again, has been a year of much work by the Council, committees and individuals of the Society. Because of inflation we felt the need to increase our subscriptions. This was a traumatic step, but we are glad to say that the majority of the membership have remained: we thank them for their loyalty. We are not out of the wood yet, but we hope we shall still be able to offer value for money. Any drop in membership because of this increase has almost been made up by a strong publicity campaign organised by Esta Koh and her team of workers. The Council wishes to thank them for their magnificent efforts. At the same time we wish to welcome the new members to our fold: we hope your time with us will prove enjoyable. It is perhaps also a time for reflection; a time to consider which way the Society needs to develop. The answers must ultimately come from the membership, and we look forward to constructive suggestions.

A research body is in the process of being formed and we hope members will assist in its activities. Unfortunately, the Bookham Common surveys have been hit by British Rail's cuts in Sunday services, but they intend to continue with the help of cars. The Sections have had varied success. The South-west Middlesex Group is thriving, but the Epping Forest Field Section has seen fit to amalgamate with the Ramblers. The general meetings have been of a high standard and better attended. The symposium held after our AGM last year proved to be a great success, and hopefully this will become an annual event. The Council thanks Tony Hutson for all his work in organising these symposia.

Membership figures have dropped again this year—probably as a reflection on the increased subscription—but the drop is much less than feared. However, the rate of newcomers is encouraging.

Ordinary members	919
Subscriber members	16
Family members	85
Junior members	60
Senior members	42
Honorary members	16
Life members	13

Total 1,151

In addition, there are some 70 members who have paid at the old subscription rate, and we have accepted such monies as donations.

It is with regret that we record the deaths of the following members: Miss B. Baylis, C. Duffin, A. E. Le Gros, Major A. H. H. Holles, Miss F. E. Jones, J. E. Lousley, J. Perrin, H. Spooner and Miss P. Wheatley. Two of these, J. E. Lousley and H. Spooner, were Vice-presidents and gave valued service to the Society. Mr Spooner joined in 1922 and was our oldest member.

We thank as usual Imperial College for allowing us the use of their rooms for our meetings, and also Mr Whitworth and his staff for the custody of our Library. Some of the publications have experienced delays, but we thank all those involved for their efforts. In concluding, Council expresses its gratitude to all those groups and individuals who have given the Society an entertaining and fruitful year.

* Presented at the Annual General Meeting, 11 December 1976.

A Re-examination of the Fossil Birds from the Upper Pleistocene in the London Basin

by C. J. O. HARRISON* and C. A. WALKER†

Summary

The Upper Pleistocene specimens on which records of fossil birds from the London Basin are based have been re-examined. The bone of the wandering albatross *Diomedea exulans* from Ilford was tested for nitrogen content and found to be of very recent origin, and hence invalid. The swan material might be referable to either the whooper *Cygnus cygnus* or the mute swan *C. olor*. The eagle from Walthamstow is a white-tailed sea eagle *Haliaeetus albicilla* and not Steller's sea eagle *H. pelagicus*.

Additional or re-identified species are a tufted duck *Aythya fuligula* from the Devensian glaciation at Walthamstow; and from the Ipswichian interglacial, smew *Mergus albellus*, junglefowl (? domestic) *Gallus gallus* and coot *Fulica atra* at Crayford, red-breasted goose *Branta ruficollis* at Grays, large extinct species of crane *Grus primigenia* at Ilford, and gadwall *Anas strepera* at Waterhall Farm.

Introduction

During the last century small numbers of bird bones were found in the Upper Pleistocene strata of the London Basin, usually during the course of collecting the more obvious mammal remains. They were identified in the main by Lydekker (1891) and Newton (1891), listed by Bell (1915) and later by Brodkorb (1963-67). The majority of these specimens do not appear to have been critically examined since. Most are in the collection of the British Museum (Natural History) but three specimens have been loaned by the Institute of Geological Sciences.

One site, Walthamstow, Essex, is from an interstadial during the later part of the last (Devensian, Weichselian or Würm) glaciation; and the others, Grays, Ilford and Uphall in Essex, Crayford in Kent, and Waterhall Farm in Hertfordshire, are within the last (Ipswichian, Eemian or Riss-Würm) interglacial.

Where specimens are identical with bones of recent species it has been assumed that they are referable to the latter, although we cannot be certain; any marked divergence is discussed.

Systematic List

WANDERING ALBATROSS *Diomedea exulans*. An ulna from Ilford, Essex, GSM 115003, originally from the Cotton Collection, no. 207, collected 1878. This was identified by Newton (1891). Apart from some very slight abrasion of the extremities the bone is complete and in good condition. Unlike other material from the Ilford deposits it is not broken or stained, and it retains some flexibility. It appears so similar to recent material that doubts have been expressed about its validity. A note with the specimen, apparently by Sir Norman Kinnear, states "this bone of the albatross is undoubtedly modern and Dr Cotton was imposed on by the workmen. N.K./39". In view of these doubts some test seemed desirable and Miss T. I. Molleson kindly arranged for the bone to be

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treated for nitrogen levels. She reported "the result is 4.12% which is characteristic of modern bones. This level of nitrogen is most unlikely to survive more than a few hundred years in buried bone. The only other nitrogen determination on bone from Ilford which I have on record gave 0.19% and is typical of Upper Pleistocene bone". In view of this there is no reason to assume a Pleistocene origin for this specimen, and allowing for the proximity of the port of London there is reason to doubt that the bone originated from a bird which had reached England unaided. It is preferable to treat the record as invalid in any context (Harrison & Walker, in press).

CORMORANT *Phalacrocorax carbo*. A left coracoid from Grays, Essex, BMNH 36633, purchased from Mr Bale, 1855. It lacks half the sternal facet.

WHOOPEE OR MUTE SWAN *Cygnus cygnus* or *C. olor*. A distal end of a left tibiotarsus from Grays, Essex, BMNH A66, presented by Sir Richard Owen, 1884. It has a note with it stating that it was found with cave bear, rhinoceros, and elephant in this deposit by Mr Ball, January 1848. A shaft of a left tibiotarsus from the same locality, BMNH A3116 (originally 36633), purchased 1855; originally labelled *Anser anser*. Proximal end of a left radius from Ilford, Essex, BMNH A3125 (originally 45809), from the Brady collection, purchased 1874. The tibiotarsal shaft lacks both ends and the fibular crest; and the medullary artery foramen is a little distal to the end of the fibular crest, although the position of the foramen appears to vary to some degree in different individuals. From the specimens it is not possible to be certain which of the two species might have been present.

WHITE-FRONTED GOOSE *Anser albifrons*. A right humerus from Ilford, Essex, BMNH 45808, from the Brady collection, purchased 1874.

GREYLAG GOOSE *Anser anser*. A left radius from Walthamstow, Essex, BMNH A3124 (originally 41766), purchased 1869. Originally identified by Lydekker (1891) as that of a brent goose *Branta bernicla*, but is much too large and agrees with *Anser anser*. A left femur, BMNH 20271, purchased 1846; and a left ulna lacking the distal end, BMNH A3117 (originally 36633), purchased 1855; both specimens from Grays, Essex. Distal end of a right ulna from Ilford, Essex, GSM 115783, Cotton Collection no. 205. The last three specimens, all from the Ipswichian interglacial, are a little larger than bones of modern specimens, and may indicate a larger race of the species at this period.

RED-BREASTED GOOSE *Branta ruficollis*. A right carpometacarpus from Grays, Essex, BMNH A3115 (originally 36633a), purchased 1855. The specimen lacks most of the proximal carpal trochlea and the bridge of metacarpal III. It is a short, stout bone, too short for that of the lesser white-fronted goose *Anser erythropus*, and of similar size to, but differing from, that of Ross's goose *A. rossii*, the latter being a small isolate of the North American snow goose complex. The occurrence of *Branta ruficollis* is unexpected since it is at present a species of very limited distribution, breeding in northern Siberia and wintering around the Caspian and Black Seas, and occasionally west to Hungary.

MALLARD *Anas platyrhynchos*. A right coracoid, BMNH 41568, and a right ulna with damaged shaft, BMNH 41568a, both from Walthamstow, Essex, purchased 1869. The proximal end of a right ulna, GSM 115786, from Ilford, Essex, Cotton collection no. 206. The proximal end of a left carpometacarpus, BMNH A4988, from Uphall, Ilford, Essex, M.A.C. Hinton collection no. M.H.510, collected 16 April 1900, presented 1962. The above specimens were previously not identified to species level, although some had been labelled "*Anas* sp."

GADWALL *Anas strepera*. A right carpometacarpus, BMNH A4987, from Waterhall Farm, Hertfordshire, collected by J. W. Simons and M. A. Lambert, 1961. The species is smaller and slighter in build than *A. platyrhynchos*.

TUFTED DUCK *Aythya fuligula*. A left humerus, BMNH 41568b, from Walthamstow, Essex, purchased 1869. Previously unidentified, although Lydekker (1891), who had inadequate anatid material, commented on it in comparison with *Aix sponsa*.

SMEW *Mergus albellus*. A left humerus, BMNH A488, from Crayford, Kent, presented by F. C. T. Spurrell in 1894. Previously labelled "*Querquedula*".

WHITE-TAILED SEA EAGLE *Haliaeetus albicilla*. A left tibiotarsus, BMNH 41567, from Walthamstow, Essex, purchased 1869. Although typical of the species, it was referred by Lydekker (1891) to the larger Steller's sea eagle *H. pelagicus*.

JUNGLEFOWL (? domestic) *Gallus gallus*. A distal end of a left radius, BMNH A489, from Crayford, Kent, presented by F. C. T. Spurrell in 1894. Previously labelled "*Querquedula*". The bone is very similar in size to that of recent wild *G. gallus*. There is a tendency to doubt the identification of junglefowl bones unless the occurrence fits a preconceived pattern. There could be four different interpretations of the presence of such bones. It might be regarded as evidence that the material was wrongly dated, or that it was correctly dated and changes our knowledge on the distribution of this species as a domestic bird at this period. It might be held to indicate the presence of a phasianid species, not necessarily *G. gallus*, which was still extant and had occurred over a wider range at an earlier period; or that a now extinct species, osteologically similar to *G. gallus*, had occurred in that area. The site at Crayford is not one in which the accidental introduction of later material was likely. There is evidence of human occupation during the Ipswichian period.

CRANE *Grus primigenia* Milne-Edwards (1871). A distal end of a left radius, from Ilford, Essex, BMNH A4961, Corner collection, no: 116, presented 1916. A number of bones from the Late Pleistocene and Holocene have been identified (Harrison & Cowles 1977) as those of a large now extinct crane similar in size to *G. antigone*, but regarded as a separate species. The present specimen is referable to this material, particularly in view of the thickness of the shaft.

COOT *Fulica atra*. The distal end of a left humerus, BMNH A490, and a broken left ulna, BMNH A489, both from Crayford, Kent, presented by F. C. T. Spurrell, 1894.

Site List

UPPER DEVENSIAN GLACIATION

Walthamstow, Essex: greylag goose, mallard, tufted duck, white-tailed sea eagle.

IPSWICHIAN INTERGLACIAL

Crayford, Kent: smew, junglefowl, coot.

Grays, Essex: cormorant, whooper/mute swan, greylag goose, red-breasted goose.

Ilford, Essex: whooper/mute swan, white-fronted goose, greylag goose, mallard, large extinct species of crane.

Uphall, Essex: mallard.

Waterhall Farm, Hertfordshire: gadwall.

We are grateful to the Institute of Geological Sciences for the loan of three specimens and for permission to test the albatross bone, and to Miss T. I. Molleson for arranging the test. We are also grateful to Dr A. J. Sutcliffe and Mr A. P. Currant for advice and information.

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Book Review

The Naturalist in Britain. By David Elliston Allen. 292 pages, 13 black and white plates. Allen Lane, London. 1976. £9.00.

Subtitled *A Social History*, this is a most informative and entertaining volume. It commences with the foundation of the organized study of natural history in the British Isles (to be precise) during the seventeenth century, and traces its “rise to fashion”, its progress through Victorian times when “that masterpiece of social mechanics, the natural history field club” was invented. Then comes “The Parting of the Ways” in which Darwin, Huxley and Owen were at the centre of controversy, and Newton, Hooker, Watson, Lyell, Morris and others were hovering nearby. This is followed by the development of the peaceful style of study in which we ourselves participate.

The book is full of anecdotes, and pen pictures of past naturalists abound. The LNHS is mentioned in three places. The ornithologist, the entomologist and the arachnologist will all notice omissions which could justifiably have been included. Also some periods have been given rather brief treatment, but these do not really detract from the value of the work. The line drawings at the head of each chapter add interest, whilst the “Notes on Sources”, given instead of the more usual bibliography, is itself very readable.

K. H. HYATT

The Marine Algae of the Tidal Thames

by IAN TITTLE* and JAMES H. PRICE*

Summary

This paper provides the first description of the benthic marine algal flora of the tidal Thames from observations made between 1968 and 1976. The distribution of marine algae in the estuary is considered in relation to the Venice-system for the classification of brackish waters. Certain floristic differences between the Thames and other British estuaries are outlined.

Introduction

The few published accounts of the benthic marine algae of the tidal Thames mainly deal with the outer estuary. Carter (1932, 1933a, 1933b) surveyed in detail the salt-marshes of Canvey Island, an area previously treated by Lambert (1927). Myers (1954) and Side (1973) investigated salt-marshes occluded from the tidal river in Essex and Kent respectively. The present work was begun in 1968 as part of a wider survey of the marine algal flora of Kent (Price & Tittley 1972a, 1972b, Tittley & Price 1977), which has subsequently been extended to include the Essex side of the estuary.

The tidal Thames has undergone many changes since the last glaciation (Ackeroyd 1973, Jelgersma 1964); the more recent of these have been brought about by human settlement in the area (Goodsall 1965, Thompson 1945). The drainage of marsh and the construction of embankments, wharves and piers began during the Roman period, when the river had extensive tracts of salt-marsh on either bank and was much wider, shallower, and slower-flowing than it is today. The growth of London and other towns along the estuary has been accompanied by widespread drainage of marshland and the construction of extensive lengths of stable embankment (Plate 1). As a result, the Thames has become narrower, deeper and much faster-flowing. Large tracts of salt-marsh still occur on Canvey Island and on the Hoo Peninsula (Plate 2) at the mouth of the estuary, while small areas remain in the middle and lower reaches at Rainham, Purfleet, Erith and Swanscombe.

Physical Environment

Many seasonally varying aspects of the environment determine the growth and distribution of marine algae. The main factors are summarised here; see [Gameson & Johnson] (1964) for further details on the Thames area.

The Thames drains eastwards into the southern North Sea and is tidal and appreciably saline for a considerable part of its length (Fig. 1). The salinity varies from that of full seawater ($> 30\text{‰}$) (=30 parts per thousand) at Southend (outer estuary) to full freshwater at Teddington Lock. Examples of salinities for a number of localities are given in Table 1. Salinity at any point in the river is not constant but varies according to the amount of freshwater flowing and to the state of the tide when readings were obtained (see also Table 1). The waters of the Thames are well mixed and show little stratification into layers of differing salinity.

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PLATE 1. River-wall and vegetation zonation at Egypt Bay, Hoo Peninsula, Kent. The dark bands in the lower intertidal are of *Ascophyllum* with fucoids above and intermixed. Photograph: J. H. Price, May 1968.



PLATE 2. Salt-marsh at Shornmead near Gravesend, Kent, showing *Puccinellia* turf, erosion front and mud fore-shore. Photograph: J. H. Price, May 1968.

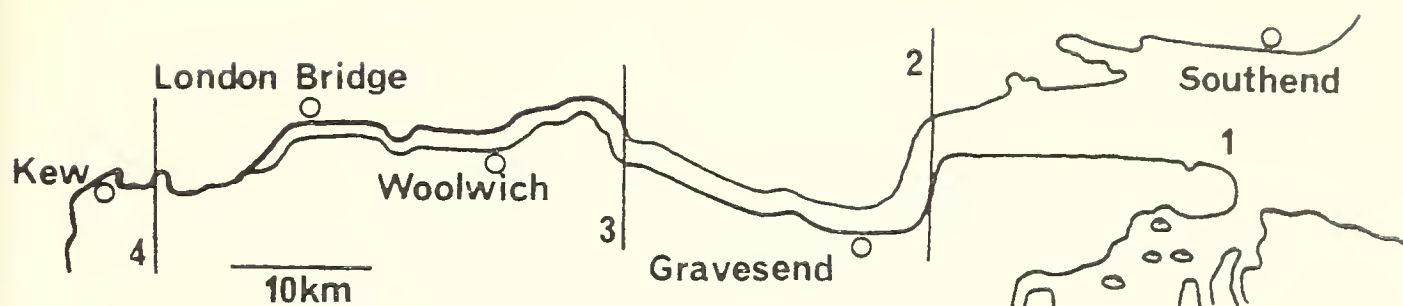


FIG. 1. Map of the tidal reaches of the River Thames showing the four sections: 1, marine section; 2, estuarine section; 3, brackish section; 4, tidal freshwater section.

The twice daily tidal sequence accords with that of most other North Sea localities; the tidal amplitude is considerable, approximately 8m (spring tides) and 4m (neap tides) at London Bridge, grading to 5m and 2m at Margate.

The serious pollution of the water by domestic and industrial effluent, at its worst during the 1950s, eliminated many plants and animals from the river; a recent improvement of conditions has reversed this trend (Price & Tittley 1972b, Tittley 1972, Wheeler 1969).

Habitats Available for Colonisation

Extensive areas of fore-shore are uncovered at low water. At many sites the intertidal consists of walls and embankments below which are areas of mud, silt and, less frequently, shingle and sand. The river walls are constructed of various materials including soft, porous and water-retaining brick or wood, and the harder, impervious granite, cement, or metal. The introduction of floating piers, pontoons and buoys has provided new types of habitat not previously available. The extensive salt-marshes in the outer estuary principally involve *Puccinellia*, *Spartina* and *Halimione* beds, frequently dissected by deep pools and channels. At the extreme mouth of the estuary there are large areas of foreshore covered by mussel beds, or by banks of shell or consolidated shingle.

The Algal Flora of the Thames

River-walls

The upriver embankments west of Belvedere and Rainham carry a dense mat of vegetation dominated by Chlorophyceae (green algae). Five horizontal bands of vegetation are recognisable on porous brick walls at Woolwich (Fig. 2a). At the high water of spring tides level there is a band of the lichen *Lecanora dispersa* (Pers.) Sommerf., together with coccoid green algal growths. At successively lower levels *Blidingia*, *Rhizoclonium*, *Enteromorpha* and diatom bands occur. This pattern of vegetation may be altered by other environmental factors. For example, in shaded positions on similar brick walls the vegetation is dominated by one of the red algae (Rhodophyceae) *Audouinella purpurea*. On walls of harder, impervious concrete, the vegetation is almost entirely of *Blidingia*; very rarely *Urospora penicilliformis* and *Ulvaria oxysperma* var. *oxysperma* f. *wittrockii* are also present. Seasonal changes, such as the replacement of spring diatom growths (golden brown in colour) by summer growths of *Vaucheria compacta* (green) and *Porphyridium purpureum* (red) are very noticeable.

In the lower reaches, by contrast, the vegetation on river-walls is dominated by brown algal (Phaeophyceae) growths. At Tilbury the sloping wall of concrete tiles and boulders carries a zonation consisting of four bands (Fig. 2b).

A band at high water level of *Blidingia* is followed by a lower band of *Enteromorpha intestinalis* and *E. prolifera*. *Fucus spiralis* separates the *Enteromorpha* from a band of *F. vesiculosus*, the latter covering the lower parts of the sea-wall and the upper boulders below it. Seawards of Tilbury, for example at Canvey Island and Egypt Bay (Plate 1), an *Ascophyllum nodosum* band is introduced between the *F. spiralis* and *F. vesiculosus* bands (Fig. 2c). Beneath the cover of *Ascophyllum* and *Fucus* there is a layer of smaller algae such as *Callithamnion hookeri*, *Ceramium diaphanum*, *Chondrus crispus*, *Gelidium pusillum*, *Polysiphonia nigrescens*, *P. urceolata*, *Pilayella* and *Ulva lactuca*.

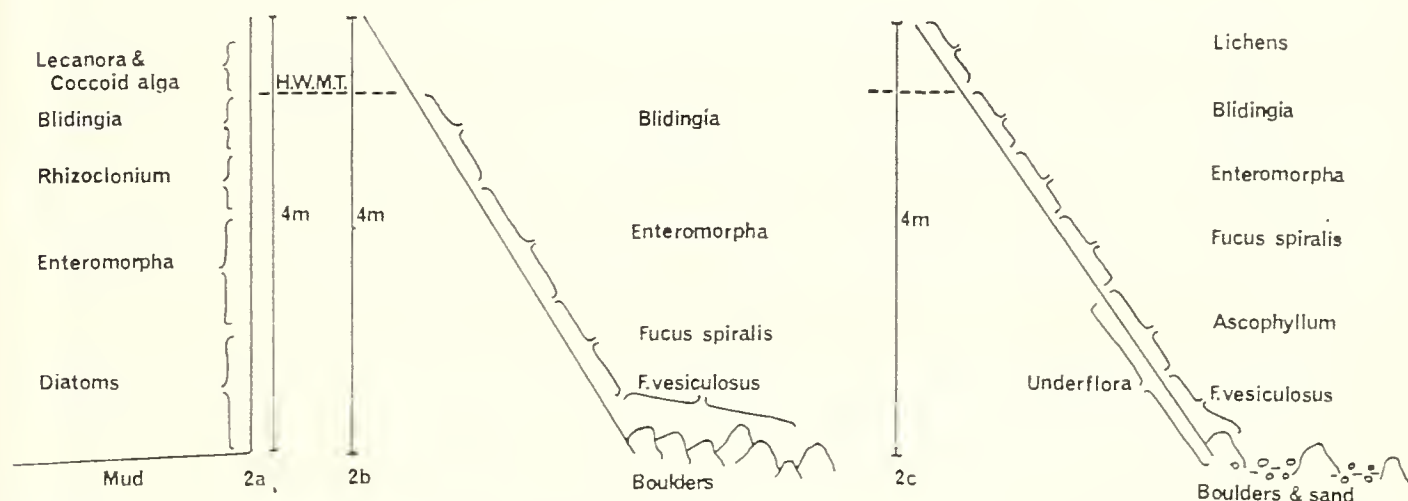


FIG. 2. Diagrammatic representation of present algal zonation patterns on river-walls at Woolwich (2a); Tilbury (2b); Egypt Bay/Canvey (2c).

Mussel, Shingle and Shell Banks

Locally in the outer estuary, the extensive fore-shore coverage of mussels is firm enough to support populations of *Fucus vesiculosus*, *Petalonia fascia* and *Porphyra purpurea*. Consolidated shingle carries a community of smaller red and green algae which include *Ceramium diaphanum*, *Chondrus crispus*, *Cladophora sericea* and *Dumontia incrassata*. The crustose *Ralfsia verrucosa* and *Ralfsia*-stage of *Petalonia fascia* are frequent on large stones and boulders. Shellboring *Eugomontia sacculata* and *Codiolum* phases of *Monostroma* inhabit the calcified parts of the abundant mussel, cockle, winkle and whelk shells. Shallow pools support *Polysiphonia nigrescens*, *Ceramium diaphanum*, *Ulva lactuca* and, during the spring, *Monostroma grevillei* and *Petalonia fascia*.

Floating Structures

The partially submerged state of these structures provides two major habitats, the upper wave-washed and the lower consistently submerged. These correspond to the littoral (intertidal) and infralittoral (immersed) shore levels. On floating structures at Tilbury and Gravesend the wave-washed habitats at water-level are colonised by *Ulothrix* spp., *Cladophora fracta*, and *Enteromorpha* spp. The lower immersed levels carry large populations of *Callithamnion roseum*.

Salt-marshes

A number of algae grow on and among the vascular plants of salt-marshes in the middle and lower reaches of the Thames (Plate 2). *Blidingia minima* and *B. marginata* occur frequently on the stems of *Halimione*, while *Enteromorpha prolifera* (frequently as the salt-marsh subspecies *radiata*), *E. torta* and *Rhizoclonium* are abundant as thick mats entwined among *Aster*, *Limonium*, *Puccinellia*,

Salicornia and *Spartina*. *Enteromorpha prolifera* is also a primary coloniser of the bare mud of wave-eroded ridges. Pools and channels are often lined with velvety growths of *Vaucheria* spp. Two common salt-marsh species *Bostrychia scorpioides* and *Catenella caespitosa* seem currently to be absent from the Thames, although both are present in the neighbouring Medway estuary. The salt-marsh forms of *Fucus* and *Pelvetia* are also lacking.

Distribution along the Estuary

The distribution of marine algae along the tidal part of the Thames is summarised in Table 1. The Rhodophyceae are mostly restricted to the fully marine outer estuary; the Phaeophyceae penetrate further into the estuarine stretches of the river; the majority of Chlorophyceae penetrate the brackish stretches and a few even extend into the freshwater reaches of the river. When salinity is correlated with algal distribution patterns in the tidal Thames four sections, each with a characteristic algal flora, can be recognised (Fig. 1); these sections are not sharply delimited but merge into one another. They are as follows:

1. Marine section: salinity at, or close to, that of full marine conditions ($<30\text{‰}$), decreasing upriver to 26‰ . In this stretch fucoids are abundant and red algae are an obvious component of the flora.
2. Estuarine section: salinity decreasing from 26‰ to 16‰ . Fucoids dominate the foreshore and a few Rhodophyceae (*Ceramium diaphanum*, *Callithamnion roseum*) occur, either at lower shore levels or in the infra-littoral.
3. Brackish section: salinity decreasing from 16‰ to 2‰ . The vegetation is dominated by mats of the green algae *Blidingia* and *Enteromorpha*, and by diatoms. Fucoids are absent. *Audouinella purpurea* (red) and *Pilayella littoralis* (brown) penetrate deeply into this section.
4. Tidal freshwater section: salinity 2‰ to 0. Here, algae restricted to freshwater occur together with a few species able to tolerate marine, brackish and freshwater conditions, e.g. *Rhizoclonium* and *Vaucheria*.

TABLE 2. Comparison of Venice-system with sections of the Thames as described by the authors.

Thames section	Salinities (‰)		Venice-system zone
Tidal freshwater section	0—2	± 0.5	Limnetic
		0.5—3	Mixo-oligohalinicum
Brackish section	2—16	3—18	Mixo-mesohalinicum
Estuarine section	16—26	18—30	Mixo-polyhalinicum
Marine section	26—30	30+	Mixo-euhalinicum
Open sea			Euhalinicum

In general, the four algal sections of the River Thames described here (Table 2), closely parallel zones described in the "Venice-system for the classification of brackish waters" (Hartog 1960). In the construction of our scheme, we have taken into consideration neither animal distributions nor water chemistry,

which may account for differences in detail. Exact correlations of boundaries are in any case rather unlikely in situations essentially both variable and clinal. However, further investigation at the tidal head of the Thames should indicate more clearly the extent of its limnetic section.

Comparison with Other Rivers

Information on the distribution of marine algae in British river estuaries is scant, only a small number of the latter having been investigated in any detail (Table 3). A wider survey of estuaries in northern Britain has been undertaken recently by Wilkinson *et al.* (1976) but precise information on the distributions of algae in these estuaries is at present unavailable.

TABLE 3. Detailed published accounts of the marine algae of river estuaries in the United Kingdom.

River Add, Argyllshire.	Wilkinson & Roberts (1974).
River Clyde, Dunbartonshire, Renfrewshire.	Wilkinson (1973a).
River Tyne, County Durham.	Edwards (1972).
River Wear, County Durham.	Edwards (1972), Wilkinson (1973b).
River Tees, County Durham.	Alexander <i>et al.</i> (1935), Edwards (1972).
River Thames, Essex, Middlesex, Kent, Surrey.	Tittley & Price (1977).
River Medway, Kent.	Tittley & Price (1977), Wildish (1971).
River Exe, Devon.	Gillham (1957).

The Thames estuary differs from many others in the absence of a hard, rocky shore along the outermost parts of the estuary. Consequently a smaller number of species has been recorded for this part of the Thames than for corresponding parts of other estuaries. Algae such as *Acrosiphonia arcta*, *Cladophora rupestris*, *Cladostephus spongiosus*, *Corallina officinalis*, *Cystoclonium purpureum* and *Laminaria saccharina* are not found on the north Kent coast west of Whitstable, where hard Eocene clay rocks occur at low water-level.

Chlorophyceae and *Vaucheria* (Xanthophyceae) are abundant in all estuaries; amongst those groups, several forms can be found throughout the entire estuarine length, e.g. *Rhizoclonium* and *Vaucheria* spp. The algae *Enteromorpha intestinalis*, *E. prolifera* and *Ulothrix flacca* occur widely in all estuaries. *Cladophora rupestris*, *C. sericea* and *Ulva lactuca* have been recorded consistently, but only in the lower reaches. The absence of *Monostroma grevillei* from five estuaries probably reflects summer sampling for a species which flourishes in winter and early spring. The absence of Prasiolaceae from the Thames and south-east England is anomalous; we have found *Prasiola* only once in the area: on Harwich harbour breakwater in the estuary of the Stour and Orwell, despite its widespread occurrence in similar situations in the Netherlands (Hartog 1959) and elsewhere in Britain (Edwards 1972).

Most of the brown algae are restricted to the lower saline reaches. The marine furoid *Fucus serratus* is widely recorded, but is absent from the Thames; this may well be because of the lack of suitable substrata at lower shore levels. The estuarine furoid *F. ceranoides* is also absent, perhaps because of the lack of suitable substrata or as a result of the excessive turbidity and pollution in the brackish reaches. *F. ceranoides* grows abundantly on walls in the estuary of the River Esk, Kincardineshire (Wilkinson in press). The saltmarsh ecotype ("var. *muscoides*") of *F. vesiculosus* is noted by Wilkinson & Roberts (1974) for

the upper reaches of the River Add; this form, which appears to tolerate lower salinities than the typical plants, is absent from the Thames estuary. In the River Medway *F. vesiculosus* was found further upriver than in the Thames; the upriver stations in the Medway were floating pontoons and *F. vesiculosus* has not been found on pontoons in the Thames. This artificial habitat type appears to influence the upriver distributions of several marine algae (see also below). The absence of *Pelvetia canaliculata* from the Thames estuary does not indicate a preference for non-estuarine habitats but is in keeping with its sporadic occurrence in the southern North Sea. The species grows abundantly on walls in the estuarine Boston Haven, Lincolnshire (Price, Tittley & Honey 1977) and in the rather similar Rye Harbour, East Sussex (Price unpublished). *Pilayella littoralis* is frequent in river estuaries and is able to grow under a wide range of salinities.

The majority of red algae are restricted to the outer marine parts of estuaries. The *Porphyra purpurea/umbilicalis* aggregate has been recorded from all estuaries but penetrates only the lower reaches. *Chondrus crispus* and *Gigartina stellata*, less frequently reported, occasionally penetrate to the brackish reaches, although in the Thames *C. crispus* is restricted to the outer marine section. *Callithamnion roseum* (in the Thames and Medway) and *Polysiphonia nigrescens* (in the Medway) are further examples of species which readily colonise floating piers and pontoons and thus have a more widespread distribution. A few red algae are known to occur very widely in estuaries, often extending to the lower salinity brackish reaches. Of these, *Audouinella purpurea* is found widely in the Thames as far upriver as Greenwich, *Bangia atropurpurea* has been found only once, at Greenhithe, and *Hildenbrandia rubra* has not been detected, although it is present in the Medway.

The vertical distribution patterns of algae on sea-walls in the outer Thames estuary are similar to those described for the Exe estuary (Gillham 1957), but *Pelvetia canaliculata* and *Fucus ceranoides* are absent. Gillham did not find a noticeable zonation in the brackish and freshwater parts of the Exe. By contrast, we have detected clear zonations of algae on firm river-walls in the brackish section of the Thames. Similar zonation patterns have been described by Hartog (1959) for many brackish water localities in the Netherlands. In such habitats, Hartog (1959) recognised certain algal communities grouped into an "Enteromorpha formation". Several of the communities correlate with the *Blidingia* and *Enteromorpha* bands described for Woolwich. Although the "Enteromorpha formation" is best developed in reduced salinity, Hartog indicates that the formation decreases in importance with further reduction in salinity, being absent from freshwater. In freshwater conditions, the standard marine supralittoral, littoral, infralittoral pattern is reduced, so that the upper and lower belts merge as the central littoral "Enteromorpha formation" is eliminated. This trend has been observed at Hammersmith and Barnes, where foreshore algal communities comprise an upper shore band of *Blidingia* and a lower shore band of *Cladophora*; *Enteromorpha* was not recorded there.

In summary, the River Thames now supports a typically estuarine vigorous marine and brackish water algal flora, which appears in large part to have recovered from the effects of previous serious pollution of the river.

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Ludwigia palustris in Epping Forest

by KENNETH J. ADAMS*

In mid-July 1976, while making a routine listing of the flora of Epping Forest ponds, slowly drying-up as a result of the severe drought, I saw the red-pigmented stems of an unfamiliar plant growing on wet mud mid-way to the centre of a pond among a prostrate carpet of *Potamogeton natans*. At that time the mud was too treacherous to get near enough to make an identification. Two weeks later, however, the incessant scorching sun had dried out the mud sufficiently to walk on, and Owen Mountford was able to reach the plant and identify it as *Ludwigia palustris* (L.) Elliot. By this time the patch had grown to a metre across and was already dying at the centre. Taking advantage of this rare opportunity to dry-dredge the pond, the forest authorities began excavating the 60 cm or so of black organic ooze and detritus that had accumulated on the bottom, and by mid-August it became possible to search for plants on the wetter patches of exposed mud near the centre of the pond. In all, five patches were located, three of them up to a metre across and spaced about five metres apart, and two further young plants less than 30 cm diameter some distance away, and very difficult to detect except at close range among the *Potamogeton* carpet. By this time, the larger plants had begun to accumulate anthocyanins in the leaves as well as the stems, and the pairs of leaves were widely separated by internode elongation and twisted into one plane so that they lay closely appressed to the substrate. All the plants flowered freely, many of the flowers having 3-4 pinkish-white petals, and fruits were produced in abundance. As most of the floras claim that *Ludwigia palustris* has no petals, there was at first some doubt about the identification, but attempts to match our plant with any other *Ludwigia* failed and the initial tentative determination was confirmed.

The pond lies in a shallow hollow excavated into a patch of superficial gravel surrounded by trees and forming a natural sun trap. Other plants present in the pond included *Apium inundatum*, *Hottonia palustris*, *Hydrocotyle vulgaris*, *Potamogeton natans* and a rare liverwort *Ricciocarpus natans*, with *Bidens cernua*, *Iris pseudacorus*, *Ranunculus flammula* and *Typha latifolia* in the marginal vegetation. Although exotic plants are occasionally introduced into the Epping Forest ponds (and are generally removed by the conservators) it seems unlikely that anyone would deliberately introduce *Lugwigia* as it is not a particularly attractive plant to keep in a garden pool. Since five widely spaced patches appeared in a very short period of time, it might appear that the plant had been there for several years in a vegetative state. According to Salisbury (1972) however, the majority of the fruits fail to dehisce and the seeds either germinate in the rotting fruits or are released *in situ* as the fruit rots, thus hampering dispersal. Thus it would seem that a duck or heron with muddy feet could have introduced either a fruit or part of a rotting fruit from one of the stations in the New Forest, or perhaps from the continent, the seed from this single fruit subsequently giving rise to all five patches as first generation plants. The fruit need not have been introduced recently. *L. palustris* is one of a group of mud species that thrive and fruit most prolifically on wet organic mud, and the seed probably remains viable in a dormant state for many years, until on rare occasions the pond dries out and the warmth and oxygen stimulate germination and rapid vegetative growth. Although formerly found at several stations in Sussex, *Ludwigia* is now confined in Britain to the New Forest, so this new

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colony is well to the north of any previously recorded. On the continent its apparent preference for areas to the south of our latitudes suggests that a climatic parameter limits its distribution to the milder southern counties here. Rather than a permanent extension of its range this occurrence in Epping Forest probably represents a freak occurrence resulting from the long dry summer. Fruits of *Ludwigia* may well lie dormant in ponds in other parts of the country which have never developed the right conditions for an overt response.

Prior to the dredging operations, fragments of one plant were removed; these were reintroduced when the mud had been excavated down to the gravel bed and the pond had begun to refill. Several fragments removed to a garden pond succumbed to the first hard frost and failed to over-winter. A few small fragments were however successfully over-wintered in a closed polythene bag in the dim natural daylight of a north-facing room, the apices growing several centimetres to form small lush green shoots while the rest of the plant died and putrified. It would seem unlikely that the vegetative fragments reintroduced to the pond will survive, as *Ludwigia* appears to be a short-lived annual in this country and rarely if ever perennates successfully. Furthermore, with the bottom mud and the marginal *Iris* and *Typha* beds now gone, the nutrient status of the pond water will probably change dramatically and it may be several decades before conditions again become favourable for vegetative *Ludwigia*. Nevertheless, this pond will be watched each year to see if the *Ludwigia* does make another appearance. Always there is the nagging feeling, however, that a botanist might have deliberately thrown in a fruit collected in the New Forest just to see if someone might report finding the plant after a freak dry summer.

REFERENCE

- SALISBURY, E. J. 1972. *Ludwigia palustris* (L.) Ell. in England with special reference to its dispersal and germination. *Watsonia* 9: 33–37.

Book Review

A Revised Key to the British Species of Crustacea: Malacostraca Occurring in Fresh Water. By T. Gledhill, D. W. Sutcliffe and W. D. Williams. 72 pages, 48 text figs. Freshwater Biological Association, Ambleside. Scientific Publication 32. 1976. £1.00.

The increase in our knowledge of the freshwater Malacostraca, which includes such diverse forms as the crayfish, freshwater shrimps, water-lice and the Chinese mitten crab, is shown by the differences between the present booklet and its predecessor in the series. The present edition has 36 more pages, 12 more figures, describes eight additional species and has 90 more references. It does not, however, include distribution maps because the results on recent research on the amphipods and isopods is not yet complete.

A New Site for the Green Houndstongue *Cynoglossum germanicum* in Surrey

by BRYAN R. RADCLIFFE*

In these days of increasing pressure on natural habitats there is a tendency for native species of flowering plants to become more scarce or even extinct near our larger cities. It is therefore very heartening to be able to report a substantial new find of one of our rarer species less than 26 km (16 miles) from the centre of London.

The green houndstongue *Cynoglossum germanicum* Jacq. has always been rare in Surrey, and in recent years has been thought to be confined to two sites in chalk woodland on opposite sides of the Mole Gap near Dorking. Its discovery in September 1976 some four km to the north-west on clay soil was therefore surprising.

The site was in the heavily wooded portion of Leatherhead Common, and the plants occurred in two discrete colonies some 150 m apart. Colony A was roughly oval in shape, about 40 x 30 m in size, on a gentle slope with a south-west aspect. The local dominants were *Quercus cerris* and *Q. robur*, perhaps 60-80 years old, in close canopy. The shrub layer was intermittent, consisting of both species of *Crataegus* (mainly *C. laevigata*), occasional *Prunus spinosa* and *Rubus fruticosus* agg. The herb layer was extremely sparse, principally of isolated patches of *Glechoma* and *Mercurialis* with single plants of *Dryopteris filix-mas*, *Scrophularia nodosa* and one tuft of *Milium effusum*. Colony B was more or less square, some 40 x 40 m, again on a gentle slope but with a western aspect. Here the dominants were *Acer pseudoplatanus* and *Fraxinus excelsior*, perhaps 30-40 years old. The shrub layer was more continuous in this colony, mainly saplings of the dominants, with single specimens of *Acer campestre*, *Castanea* and *Thelycrania*. The herb layer was more diverse, but with much bare ground. Plants seen were *Ajuga*, *Dryopteris*, *Endymion*, *Mercurialis*, *Milium* and *Viola*.

A total of 620 juvenile plants of *Cynoglossum germanicum* were counted in colony A and 327 in colony B. Plants were considered to be juvenile if they had not flowered, although among these there was considerable variation in size, from individuals with two leaves to those with ten. It is probable that many of the larger juveniles were more than one season old. Experience elsewhere indicates that this species, although invariably monocarpic, is not always biennial in the normally accepted sense. In conditions of low light intensity the rate of growth is slow, and the plant will need a second and possibly even more seasons in the juvenile condition to accumulate sufficient reserves to attain flowering status.

Plants that had flowered and carried fruits were also counted. 115 were found in colony A and 46 in colony B. The majority of these showed the normal autumnal appearance, i.e. with many of the leaves still present but the whole plant brown. However, a significant number were simply skeletons with rows of fruits attached, and the fruits presented a greyish, bleached appearance, quite distinct from the usual mid brown colour. It is reasonably certain that these individuals had fruited in 1975 or even earlier.

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Leatherhead Common resembles the more wooded portions of the adjacent Ashted and Epsom Commons which vary from mildly to strongly calcifuge. Some parts of the common are clearly of a calcifuge type, the herb layer consisting almost entirely of *Holcus mollis* and *Pteridium aquilinum*. The area of the *Cynoglossum* colonies was less obviously calcifuge, but nevertheless appeared to be of a somewhat acid character.

Soil samples were taken at 10 m intervals along line transects running east-west across both colonies. Before sampling, the leaf litter and top 2 cm of soil was removed. The underlying soil between 2 and 7 cm was mixed and the samples taken from this. Acidities were determined in a laboratory using a Pye pH meter, with the following results:

west	6.4	5.6	<div style="display: inline-block; text-align: center;"> \triangleleft ————— colony A ————— \triangleright </div>					5.8	5.5	east
			6.8	6.9	6.3	6.2				
west	6.1		<div style="display: inline-block; text-align: center;"> \triangleleft ————— colony B ————— \triangleright </div>					5.3	5.5	east
			6.2	6.3	6.6	6.2	7.2			

The following results are of interest:

- All except one of the pH values was on the acid side of neutral.
- Mean values inside the colonies were higher than outside; inside both, approx. 6.5 : outside colony A—5.8 : outside B—5.6.
- The lowest pH recorded inside the colonies was 6.2.

The very limited number of tests do not allow any conclusion to be drawn concerning the minimum pH at which *Cynoglossum germanicum* will grow, nor indeed that pH is necessarily of particular importance. The significant point that emerges, however, is that the species can thrive and reproduce naturally in an acid soil.

It may be noted that both the other Surrey sites are on very chalky woodland slopes, and the species has been regarded as a calcicole. Its abundance on acid clay in this new locality indicates that the tolerance for different edaphic conditions is wider than previously expected.

I would like to acknowledge the help given by my son, David Radcliffe, who carried out the pH determinations.

Book Review

An Illustrated Key to Freshwater and Soil Amoebae with Notes on Cultivation and Ecology. By F. C. Page. 155 pages, 64 half-tone and line figures. Freshwater Biological Association, Ambleside. Scientific Publication 34. 1976. £2.50.

Although a little expensive, even at today's levels, this welcome publication fills a gap that has been with us for far too long. It serves as an *introduction* to a group of at first sight very homogeneous organisms that were made known to us very briefly when we were at school. Methods of collecting, cultivation, handling of pathogens, and observation are given. Keys to families, genera and species follow, and these are well illustrated with 115 line drawings and 167 photomicrographs (the latter accounting for the cost of the publication). The three pages of references include some useful works not mentioned in the text.

K. H. HYATT

The Wild Service Tree

Sorbus torminalis in Epping Forest

by ERNEST G. LLOYD*

Summary

An investigation of the distribution and abundance of the wild service tree in the northern half of Epping Forest was carried out during the spring of 1975. Geology, drainage and forest management seem to have affected distribution. Most of the sites occurred on Claygate Beds near the 60 m contour and were well drained. The growth of the tree is discussed and an explanation for the leaning trunks is suggested.

Introduction

Although the wild service tree *Sorbus torminalis* (L.) Crantz is distributed throughout most of southern Britain, it is usually rather rare and normally only single trees are found. However, in Epping Forest the tree population is much larger making it possible to compare in detail individuals growing under similar conditions. A number of trees are well over 100 years old, but there are also many young trees. Most of the older trees have been pollarded, although standard trees occur in two isolated areas which were presumably enclosed. In addition, there are old trees of coppice origin in another area.

During the spring of 1975 an investigation into the distribution of wild service in the northern half of Epping Forest was carried out. The objects of this survey were:

1. To place on record at the Epping Forest Conservation Centre a list of the trees present, recorded by map reference.
2. To record the state and type of tree growth and the state of regeneration.

It was hoped that this study would help to determine any common factors affecting the distribution and form of the species, to help to explain why so many trees of all ages lean over, to account for the origin and limited scatter of the trees present and to suggest the prospect for the future of the wild service. To carry out this survey, I visited every tree known to me, made measurements and recorded the data in a standard pattern. Where necessary soil samples were taken to confirm the nature of the soil.

Results

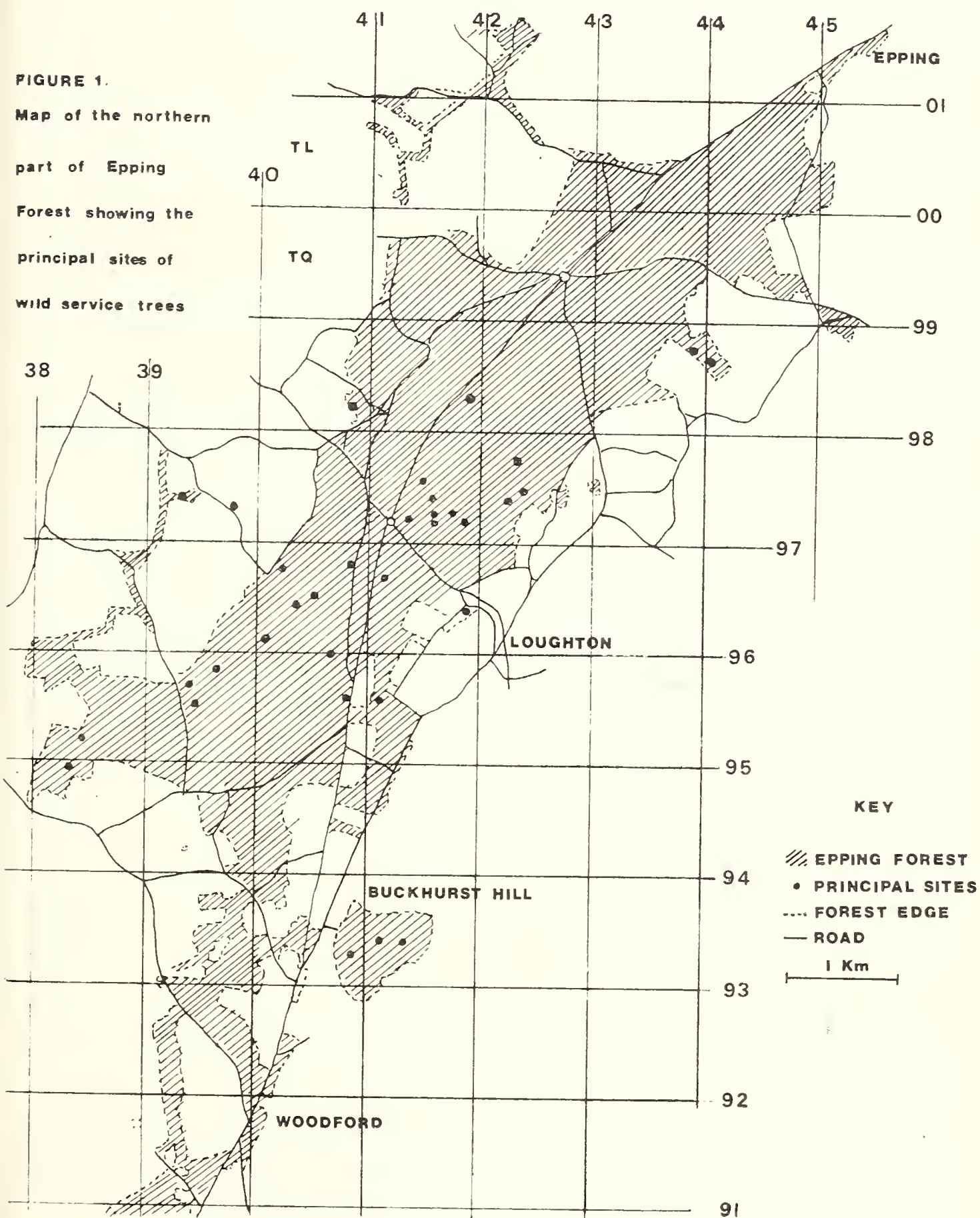
The trees visited are those listed in Table 1. A total of 271 are known, and these represent all trees and saplings found to date which are now self-supporting, i.e. over 5 cm in girth. These trees are scattered over 57 sites, counting as a site any tree or group of trees too far from the nearest others to be of the same clone. Of the young trees and saplings most are grouped at two very good sites. The largest tree measured had a girth of 198 cm and had been pollarded. The largest standard tree had a girth of 172 cm.

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TABLE 1. Wild service trees visited in Epping Forest.

Pollards	24
Standards with girth over 50 cm	37
Saplings with girth between 15 and 49 cm	84
Saplings with girth between 5 and 14 cm	126
Total	271

FIGURE 1.
Map of the northern
part of Epping
Forest showing the
principal sites of
wild service trees



Distribution

The map (Fig. 1) shows the principal sites where trees are found. By using this map in conjunction with the geology map of the area and soil samples, the following observations can be made.

Forty-seven of the 57 sites are on Claygate Beds and are at an altitude of between 50 and 70 m: most are on the 60 m contour. Two sites are on glacial gravel and five are on London Clay. The trees growing on the two sites on gravel and one on clay, were, I suspect, planted, and the rates of growth for these trees are much lower than for those on the Claygate Beds. At two other sites on London Clay the trees are small bird-sown seedlings, and it is not yet possible to tell how they will develop. Hence Claygate Beds seem to be the preferred substrate.

Another factor common to most sites is that they are within 100 m of a stream or main ditch and about 6 m above it. Possibly good drainage is important. Even those trees in Chingford Plain area, which is generally flat clay, occur on the higher parts, presumably where the drainage is better.

The species appears to be very selective in choice of site: however the scatter is by no means general throughout appropriate sites. Large areas of the forest apparently suitable for its growth are without any representation at all: for example, there are many sites on the Claygate Beds on the 60 m contour where the species does not occur.

It is possible that up until 1878 when forest management was taken over by the conservators, forest management policy of the various manors affected distribution. This is because the majority of trees now to be found are either within the boundaries of Loughton Manor or in a small area at Chingford of Sewardstone Manor. Other manors may have removed trees in earlier times. Several trees do occur, however, in these other manors, but always in hedgerows or boundary banks where the management would be of hedgerow rather than woodland. Near the site of the Dick Turpin Cave Public House on the boundary bank of the forest, there is a pollard with two suckers. This is now on private land and may have been protected. Another group at Blind Lane, on the boundary bank of the old drove road, is of coppice origin and may be very old. There are also two groups in Lords Bushes in Chigwell Manor: a small piece of forest land isolated from the main forest block over 100 years ago, in addition to at least one tree on what is now farm land nearby. These examples seem to indicate that possibly the species was scattered throughout areas where it is not now represented. There are two trees in Knighton Wood which are suspected introductions, for both occur on incompatible soil and are not growing well.

Sucker Growth

In attempting to ascertain the origin of trees, it was noticed that some trees were straight while others had characteristic bent stems. On further investigation, those with bent stems seem to be of sucker origin.

The wild service has great powers to throw out suckers, often in very great numbers. The tree in the Coronation Plantation was recorded in 1892 as throwing up very many suckers (none of which have escaped to form new trees). Only the old tree remains, still with masses of suckers.

The suckers of wild service trees seem to be of three types:

1. Groups of weak stems close to the trunk. These stems rarely survive the first year and are replaced the following year by a similar crop. This pattern is repeated year after year until a large lump forms on the side of the root, and appears to be like that of beech *Fagus sylvatica* L. where masses of twigs form from the callous growth sealing over the damaged root.

2. Slow growing stems originating from the end of a weak side root usually not far from the trunk. They take on an angular form, often lying on the ground for a year or two, evidently not being self-supporting. The resulting growth is seen to zig-zag, each year's increment growing at an angle to the previous one. This type of sucker rarely escapes to form a sapling, although in two cases, one a pollard and the other a coppice standard, a very large number of saplings have been established, in the latter case numbering 70, from 2 to 15 cm in diameter. This is exceptional, possibly due to its good position on the bank of a road cutting where particularly good drainage may have arisen from soil disturbance. Elsewhere the vast majority seem to remain stationary at about 1 m tall and produce only a minimum of leaves and minute increments. A group I watched for five years seem to be no larger now than when I first saw them.

3. Suckers that normally produce regeneration. Most of the trees of the forest seem to originate by this means. The parent tree sends out a "runner root" which reaches far beyond the spread of the tree; it can often be traced by observing small groups of the first type of sucker spread out along its course. When the right position is reached, presumably determined by the soil, drainage, and exposure, growth commences from near the end of the root. Distances of up to 110 m have been measured.

An examination of a typical specimen illustrates the means of regeneration. The runner root produced a side shoot or sucker which grew upwards in a curve (in this case with a radius of 5 cm) and started strong upright growth. In the second year one of the buds also commenced to grow upward parallel to the main stem giving a two-stem sapling. The annual growth rates are shown in Table 2. This growth rate is very good, the girth at ground level being 8 cm. In five years the sapling had reached almost 150 cm in height, and was clad with branches spreading in all directions, with lateral growth averaging 23 cm on each branch.

TABLE 2. Height of wild service gained each year (in cm).

	Year	1	2	3	4	5	Total height
Main stem		18	15	38	33	40	144
Secondary stem		20	18	13	36	33	120

Below the ground the root continued its outward course. As the sucker developed, an additional root formed from the bulge and in five years both old and new roots beyond the sucker were of larger diameter than the original (Fig. 2).

During its growth the sucker developed a curve, first leaning back towards the parent tree, then straightening up. This growth suggests that the successful sucker is one that is able to quickly establish its independent root system aided by the end of the runner root, so that all the water collected by the roots now goes direct to the sucker and not to the parent tree.

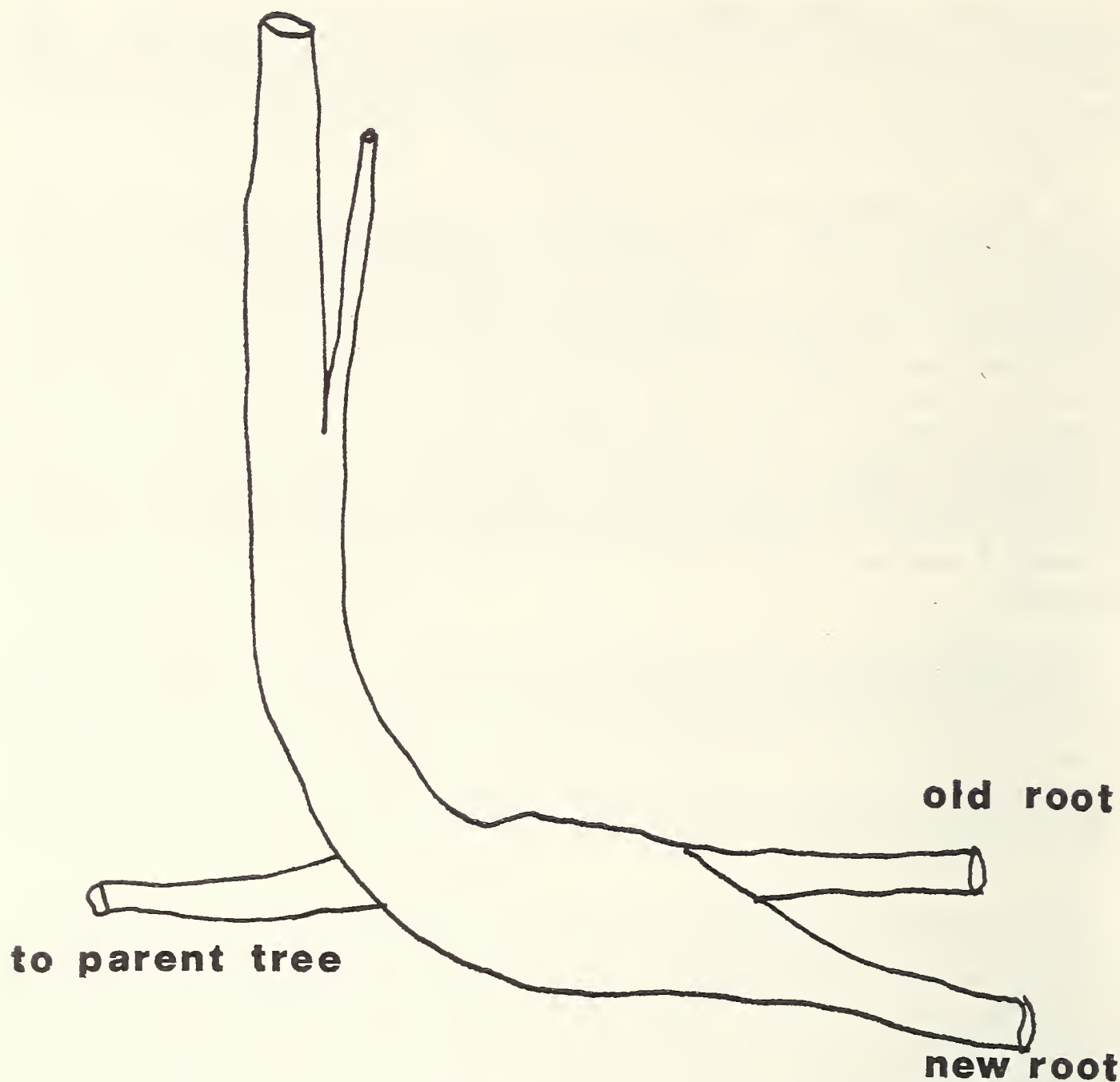


FIG. 2. Five year sucker, 32 m from the parent tree.

One might have expected the sucker to have curved away from the parent tree as it came to the surface. Yet, from many suckers examined, it is evident that the curve is towards the parent, or back towards the line of the root if the runner root had turned in its course. The curve is never lost for, in spite of the incremental build-up all around the stem, the stem often does not quite reach the perpendicular. The resulting trees show a definite lean at the base for several decimetres, then become upright trees, or trees that appear to lie on the surface then turn upwards. Once the perpendicular position is reached the tree then grows naturally, spreading its branches in all directions. Pollarded trees show this same lean at the base; growth above the point of pollarding is that of a normal tree (Fig. 3). Hence it is unlikely that the lean is caused by the tree seeking light, avoiding competition with other trees, or heeling over if the tree was not root-secure.

There is no common factor in the direction of the lean other than that shown by the five-year suckers. The direction of the lean is independent of slope, compass bearing or position of neighbouring trees. Of the 57 sites, 34 sites have trees with bent stems. The reason why so many trees lean may well be that they originated as suckers.

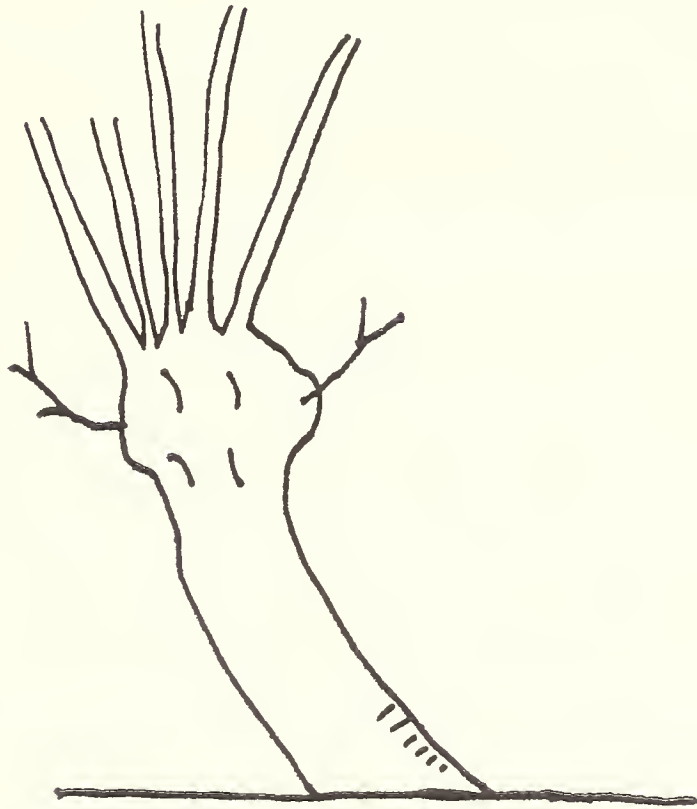


FIG. 3. Old pollard showing characteristic lean.

Other Methods of Regeneration

Two other classes of trees may be identified:

1. Trees of seed origin.
2. Trees of unknown origin that have been coppiced.

Trees of seed origin grow as normal upright standard trees, with straight stems and no trace of unequal growth or thickening around the base, other than that by buttress roots evenly distributed around the stem. Although the wild service is noted for the large crop of fruit it carries each year, few reach germination, as rabbits and other browsing animals find them palatable. Successful germination may only occur when a bird, startled, drops undigested food. Single saplings on a grass ride, a path and a roadside verge are likely to have arisen in this way. There are not many of these (perhaps five), but two fine specimens can be found on the upper slope of White Hills.

The coppiced trees are quite distinctive for they have a large bulge around the base and often consist of two or three stems of a similar size. The trunks are upright with no lean or bend. Good examples can be found near Ludgate House and in some areas where scrub clearance took place before 1939. Coppiced trees may grow very rapidly. I found a group of coppice stools cut back the previous year where new growth during the first half of the growing season had reached nearly 50 cm in length.

Age of Trees

The estimation of ages of rare trees, especially after pollarding, is very difficult. Ring counts are not available, and the use of an increment borer prohibited, but a reliable estimate can be made from the fact that the old trees have been pollarded. This was last carried out 100-150 years ago, but until then pollarding occurred at about every 15 years. Further, it is clear from the callous covered heads to the trunks that they had been cut on possibly five or more occasions.

The number of years since last pollarding is easy to obtain since it was the practice to cut all trees (except oak) irrespective of species in a given area, and ring counts on felled or fallen beech (many of which have been taken by the writer) give this information.

From this evidence we know that the minimum age for the pollards is 200 years, and for all standards under 150 years.

Conclusions

It now seems clear that the majority of older trees are of sucker origin and that it is these older trees which throw out the long sucker roots. This suggests that the wild service tree has been present for a very long time. Since the estimated age of many pollards is about 200 years old, they may have in turn originated from a tree of similar age, thus implying that the wild service tree has been present for at least 400 years. Further, if the saplings of today send out suckers in old age, it is reasonable to assume that, subject to forest management policy, the species will be present for possibly another life span from the present.

I am grateful to the Epping Forest Conservation Centre for the use of their facilities throughout this study, and to Judith Smith for her assistance with the manuscript.

The Elms of Tooting Bec

by J. E. LOUSLEY*

*On 13 January 1937 the late Ted Lousley addressed the Streatham Antiquarian and Natural History Society on the subject of the historical significance of the Dutch and English elms *Ulmus* in Tooting Bec Road, London Borough of Wandsworth, in relation to the eighteenth century Thrale estate. After his death the typescript of his lecture came into our hands, and the recent mortality among our *Ulmus* populations has so revived interest that it now seems worth publishing an abridged version.*

Last spring our worthy secretary Mr Bromhead handed to me a copy of a letter addressed by Mrs Piazzini to her daughter Queenie . . . This letter, dated 14 April 1806, reads:

“Your Grandfather planted the Common (as I always understood) Tree for Tree against this Duke of Bedford’s Grandfather: and your Papa used to say what good Elms his People put into the Ground—true English timber; and what paltry things the Duke’s Steward set; Dutch Fellows as Mr Thrale called them that never put out their leaves till yours were all Green—I think you must remember his saying so—The Speech came once a Year”.

The letter referred to Streatham Park which was purchased by the Thrale family from the Duke of Bedford who then owned what is now Tooting Bec Common. It is thus clear that if it can be established that the remains of two rows of elm *Ulmus*, Dutch and English, tree for tree, still exist, then the precise boundary on the north side where it abutted on Tooting Bec Common would be fixed. Knowing that Streatham Park, the Thrale estate, included roughly West Drive, North Drive, Ullathorne and Aldrington Roads which were built on the site, I fully expected to find that if the historic elms still existed they would be those on each side of Tooting Bec Road which would then have been the boundary. But, as will be shown, I had good reason to change my views.

Now it will be noticed that the letter says that it was Queenie’s grandfather, Ralph Thrale, who died in 1748, who planted the English elms . . . We may therefore be sure that both rows of trees were planted within a few years of one another between the purchase of Streatham Park by Ralph Thrale and his decease in 1748, which places the age of the elms at about 200 years.

The Dutch Elm . . . was introduced into Britain during the reign of William III who died in 1702, and was at first extremely popular. In planting these trees therefore, the Duke’s steward chose the elm which was then fashionable. But it was gradually realised that this arboricultural novelty had its drawbacks—that the timber was of inferior quality, and that it was unsuitable for avenues and other ornamental work owing to the abundant suckers which sprung up to form an untidy thicket round the trunk, and the not too graceful arrangement of the branches. Hence as Dutch William’s imports grew up they lost favour, so that by 1768 we find Miller in his famous *Gardeners Dictionary* saying the wood “is good for nothing, so it is almost banished this country”. This unpopularity of *Ulmus x hollandica* Mill. has lasted to this day. It would be about the time when Miller wrote these words that Henry Thrale, Ralph’s son and Queenie’s father, made his “speeches” about the “paltry . . . Dutch fellows” set by the Duke. So he also was in the fashion of his day . . .

* Deceased; an obituary appears in *Lond. Nat.* 55: 63–64 (1976).

On the first of my visits to the elms which are the subject of this paper I had the advantage of the company of my friend Dr R. Melville of Kew Gardens who is now our foremost authority on elms. The advantage of such expert help is apparent when I point out that we had not only to distinguish between the various kinds of elm to be found, but also to estimate the relative ages of the trees.

Proceeding down Tooting Bec Road to near the junction with the road known as The Avenue, it will be seen that it is flanked on both sides by fine old elm trees. Those to the north of the road are mostly English elms of fair age, but not nearly so old as the Dutch elms which occur as every second or third tree in the row to the south of Tooting Bec Road. These Dutch elms might well have been planted during the lifetime of Ralph Thrale, and are now much lopped in order to make them safe for people passing underneath . . . Between these old Dutch trees, there are a number of younger Dutch trees which have grown from suckers from the old; many English elms which have probably been planted since the authorities took over the Common; and near the new athletic ground several of the graceful Huntingdon elms which are quite recent additions . . .

Between this row and North Drive there is first Johnson's Walk (as we like to call it), then a few young trees and suckers, then a ditch, then a fence, then a very mixed belt of shrubs and trees and finally the road of North Drive. In this belt, obscured by the various recent trees which have been closely planted around them, are at least seven sizeable English elms. Furthermore there are numerous suckers and young English elms such as would arise after old trees had been cut down. Also, a few such suckers, together, it must be admitted, with one Dutch elm sucker, have crossed the fence and reappeared by the ditch between the police box and the athletic ground, more abundantly to the Streatham side.

Dr Melville and myself are strongly of the opinion that on the evidence of the elms, the ditch still existing in Johnson's Walk is the actual old boundary of the Thrale estate, and that remains of the rows of Dutch and English elms planted on the Duke's and the Thrales' sides of it respectively can still be seen. Neither does this boundary disagree with that given on the map in Mr Bromhead's book *The Heritage of St Leonards*. That this ditch, now dry, was once more important we know from our member Mr Phelps who well remembers that as a boy it was a haunt of frogs (and ? tadpoles). The facts as given by Mrs Piazzini fit perfectly, with the one slight exception that the Thrale English elms are not absolutely exactly "Tree for Tree" with the Bedford Dutchmen. Numerically over short distances the two rows are practically the same . . . and it is probable that the deficiencies are due to old trees being cut or blown down, but even so the Thrales' trees were not planted with quite the same mathematical precision as those of the Duke of Bedford . . .

If my conclusions are correct Tooting Bec Road was constructed on land which once belonged to the Bedfords, and even more important to us, the path we wish to call Johnson's Walk was outside the Thrale boundary . . .

Before I close I should like to mention briefly an important and most interesting discovery that arose out of this work. In order to make quite sure that there were no other remains of ancient Dutch or English elms in the vicinity, I took a short walk with Dr Melville on the north side of Tooting Bec Road. Suddenly he stopped and picked up an old poplar catkin from the ground and suggested that it was a female black poplar *Populus nigra* L. Now the true black poplar is a rare tree in Britain and, strange to relate, is practically always

male, so much so that the female tree has become a sort of botanical "will of the wisp". Even the British Museum (Natural History) had immense difficulty in obtaining catkins to illustrate. Naturally we looked round and found the tree from which the catkin had fallen, and congratulated ourselves on a first class and quite unexpected botanical discovery. But the sequel is not less remarkable. My friend Dr Burges of Birmingham has also been taking some interest in poplars, and while I was staying with him in August last he astounded me by saying that he intended to make a special journey to Tooting Bec Common to try and find the female black poplar which at one time grew there. It appears that the herbarium of W. Whitwell, a keen and efficient botanist who at one time lived in Thurleigh Road, near Balham, is preserved at Birmingham, and that this collection contains a specimen of this great rarity. Naturally I was able to direct my friend to the very tree!

Postscript (C. T. Prime* and R. A. R. Clarke)

Tooting Bec Common has greatly changed in appearance since J. E. Lousley read his paper in Streatham in 1937. Almost all the elms have died a natural death or succumbed to Dutch elm disease. More than that, the landmarks mentioned by Lousley have also disappeared. The police box has gone, and the numbered lamp posts shown on his sketch map have been replaced by others with different numbers; the fences shown in his photographs have gone, and most of the houses in North Drive have been replaced with blocks of flats. The ditch which he considered to mark the boundary between the Thrale and Bedford estates has been filled in, but it can just be traced as a bank for much of the length of North Drive. On the south side of Tooting Bec Road there are a few elm stumps, possibly the remains of a line of old English elms marked on Lousley's map, which still grow suckers. Further west there are two trees, daughters of the originals, but these are dying and due for felling shortly. On the north side there are only a few suckers coming through the ground to mark the site of the former avenue of large trees, and one or two recently planted small wych elms. Lousley was fortunate to record the elms of the common when they were near their best; we were too late to see anything but the merest traces. There is no trace of *Populus nigra* mentioned in the sequel.

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Hemiptera - Heteroptera of the London Area

PART XI

by ERIC W. GROVES*

(Previous parts of this paper have appeared in *The London Naturalist* as follows: Pt. I (43: 34-66, 1964); Pt. II (44: 82-110, 1965); Pt. III (45: 60-88, 1966); Pt. IV (46: 82-104, 1967); Pt. V (47: 50-80, 1968); Pt. VI (48: 86-120, 1969); Pt. VII (50: 87-94, 1972); Pt. VIII (52: 31-59, 1973); Pt. IX (54: 21-34, 1975); and Pt. X (55: 6-15, 1976). A continuing list of abbreviations as to sources of records and for recorders' names has appeared whenever appropriate at the beginning of the parts listed above).

MIRIDAE (CAPSID BUGS) (*Contd*)

Subfamily: MIRINAE (*Contd*)

Acetropis gimmerthali (Flor.)

Sp. 410 p. 303

D & S p. 291 (*A. seticulosa*)

S p. 220

B p. 364 (Sp. 259)

Occasional. This bug is associated with various species of grass though more particularly on oat-grass *Arrhenatherum elatius* and found on several of the commons, heaths, etc., in the London Area. The adults have been taken from mid-June to early August. Records are required for Essex.

MIDD. Highgate, JAP (BM).

HERTS. Berkhamsted Common, 6.vi.47, CHA (EMM 85: 91 (1949)); and just over the boundary at Harpenden, 12.vii.55, GGES (HD).

KENT. Plumstead, 1898, WW (39); Kidbrooke, WW (4) (39) (22); Birch Wood, DS (BM); vi. & vii.1865, several ♀♀, JAP (BM) (28) (4) (37) (22); Wickham, JAP (BM); and on the boundary at Sevenoaks (Knole Park), 29.vi.60, KCS (14) (22).

SURREY. Wimbledon Common, vii.1879 & vii.1880, ES (HD) (3) (37); 2.vii.1882, EAN (C); 21.viii.1896, on grasses in ravine, EAN (C); n.d., EAN per JHK in Harwood coll. (BM); Box Hill, 29.vi.42, FJC (SL) (62); Mickleham Downs, 25.vii.63, a single adult swept, AAA (51); Epsom Common, FJC (62); Ashted Common, 19.vii.47, FJC (SL) (1/1947-48: 67); 10.vii.48, FJC (SL); Bookham Common, 1.vii.49 ♂ & 15.vii.49 ♀ FJC (SL) (62); vii.15, WJA (SL); 30.vii.51, DL (HD); vii. & viii., DL (34); 19.vii.53, in damp grass area, and 14.vi.53, in dry grass area, EWG (24); 10.vii.55 & 14.vii.58, V instar larvae, EWG (24); Oxshott Heath, 16.vii.1899, ECB (NM in ECB register); WW per FJC (62); West End Common, 9.vii.51 & 29.vii.52, FJC (SL); Arbrook Common, 24.vi.52, FJC (SL); and on the boundary at Egham, 10.vii.54, GEW (40); and at Byfleet 19.vi.15, FJC (BM); 2.vi.49, FJC (SL) (62); and beyond at Woking, vii.1871 & vi.1892, ES (HD) (36) (3); vii.1871, ES in EAN coll. (C); by the Basingstoke Canal between Pirbright Bridge and Frimley Green, 1954-55, HDS (50); and Milford, 13.vii.63, PSB (16).

BUCKS. On the boundary at Chalfont St Peter, 17.vii.25, EAB (BM); and beyond at Burnham Beeches, 22.vi.12, EAB (BM); and Turville Heath, 18.vii.65, WJLeQ (21).

Stenodema calcaratum (Fall.)

Sp. 411 p. 303

D & S p. 286 (*Miris calcaratus*)

S p. 222 (*M. calcaratus*)

B p. 352 (Sp. 252, *M. calcaratus*)

Abundant and widely distributed on commons, pastures, waste ground, along rides in woodland as well as on marshy ground and in the grass at sides of ponds. Both the adults and larvae feed on the flowers, buds and unripe seeds of various species of grasses particularly the common bent *Agrostis tenuis* and

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meadow foxtail *Alopecurus pratensis*. The species overwinters in the adult stage, and in spring after pairing in May the eggs are laid in grass spikelets during June and early July. Various instars of the larvae have been taken up to the end of July and the adults from then until the end of September.

MIDDX. Hampstead, 4.viii.43, *CHA* (17); Hampstead Heath, 1949, *DL* (1/1949-50: 36-38); 2.viii.56, adults, *DL* (54); Finchley, 24.iv.43, *CHA* (17); Edgware (Scratch Wood), 28.vii.60, *DL* (HD) (54); Ruislip, 1963, *PSB* (16); Ruislip LNR, overwintered adults taken between May & July 1955-58, V & IV instars taken on 29.vii.55 and 18.vi.57 respectively, and adults of the year taken in August (2.viii.64, *RAPM*) and September 1.ix.53 *EWG* (49) (24); Northwood, 22.x.43, & 20.xi.43, *PLJR* (20); Harefield, 23.x.43, *PJLR* (20); Uxbridge, 23.viii.64, *PJLR* (MM); and Hounslow Heath, 6.viii.52, *GEW* per *DL* (54).

HERTS. Whetstone, 29 & 30.vi.60 ♂♂, 11 & 18.vii.60 ♂♂ and 1 & 4.viii.60, all taken in MV light trap, *PHW* (*pers. comm.*) & (47); Barnet, viii.1885, *EAB* (BM); Elstree, 22.vi.60, *DL* (HD) (54); Watford, 27.vi.60, *DL* (HD) (54); Rickmansworth, 7.viii.35, *DCT* (12); West Hyde, 14.ix.34, *DCT* (12); Chorley Wood Common, 27.v.63, *PSB* (16); Radlett, 26.vi.60, *DL* (HD) (54); 20.vi.60 ♀, with ripe eggs, *DL* (54); and just over the boundary at Harpenden (Rothamsted Expt. Station grounds) 1933-36, 29 ♂♂ and 10 ♀♀, taken in light trap, *DCT* (54); 5.vii.55 and 20 & 21.ix.54, *GGES* (HD).

ESSEX. Walthamstow (Wood Street), 12.vi.1895 & 22.vi.1892, *EAN* (C); Chingford, vii.1892, *EAB* (BM); Epping Forest, generally distributed, taken by sweeping in grassy places, *CN* (35a); (Loughton) 14.viii.25, V instar, *EAB* (BM); and beyond the boundary at Widford, viii.53, *JHF* (42); and Danbury Common, viii.53, *JHF* (42); 10.vii.66, *PSB* (16).

KENT. Blackheath (garden at 63 Blackheath Park), 23.iv.59, 16.viii.59, 28.vii.68, 6.ix.62 (brown form), 22.iii.61, 3.v.69 (1 green & 1 dark form), 4.v.69, 19.v.69, 12.vi.69 & 3.vii.69, by sweeping grass in the garden, most occurring singly; 4.iii.61 (3 ♀♀ & 1 ♂ barely greenish) and 6.viii.59 taken at ordinary electric light; rather more common (both sexes) at MV lamp but 3 on any night is about maximum, *AAA* (51); Plumstead *WW* (39); *AAA* (22); Abbey Wood, 16.vii.62, *AAA* (51); Lewisham, *D&S* (28) (4) (22); *WW* (39); Lee, *WW* (39); Darenth, *D&S* (23) (4) (22); n.d. *FPP* (HD); Darenth Wood, 6.v.60, *AAA* (51); Farningham Wood, 31.v.62, *KCS* (14) (22); Chislehurst Common, 29.xii.56, *KCS* (14) (22); Bromley, 7.ix.64, *PJC* (63); Shoreham, 19.i.64, *KCS* (14); Magpie Bottom, 30.iv.62, *KCS* (14) (22); near Westerham, 30.vi.68, *PSB* (16); Westerham, 25.ii.22, *PH* (BM); (Hosey Common) 17.vi.51, *DL* (1/1951-52: 72) (22); (Squerries Park), 24.vii.60, *AAA* (51); and beyond the boundary at Higham Marshes, 28.vii.66, *AAA* (51).

SURREY. Wimbledon Common, 10.vi.1883, 25.vi.1882 & ix.1892, *EAN* (C); 21.viii.1896, by sweeping in ravine, *EAN* (C); 11.ii.05, *ECB* (NM); 25.vi.55, *EWG* (24); Cheam (Nonsuch Park) 22.vii.55, III instar larva, *EWG* (24); Purley Downs, 7.v.1893, *AJC* (HD); Banstead Heath, 3.ix.62, *PSB* (16); Caterham (Pilgrim Fort) 21.ix.68 & 9.v.70, in grass on the tip, *KCS* (14); Limpsfield, 22.iii.43, *CHA* (17); Merstham, n.d., *JAP* (BM); Reigate, *GBR* per *FJC* (62); [prior to 1867], by sweeping in Redstone fields, *J&TL* (32); Headley Lane, 22.ix.1899 *WW* (SL); Box Hill, *WW* per *FJC* (62); 2.x.55, *EWG* (24); Ranmore Common, 31.x.45, *FJC* (60) (62); Epsom Common, 6.ix.53, adult ♂ & ♀, V, IV & III instar larvae, by sweeping at edge of cultivated area, *EWG* (24); Ashted Common, 21.vi.43, *FJC* (SL); 15.viii.46, *FJC* (SL) (60) (62); 29.ix.60, MGM (1/1960: 94); Bookham Common, 8.vi.31, *FJC* (SL) (60); 15.vi.49, *FJC* (SL) (62); 19.vii.53, 9.viii.53, 12.viii.56, 16.viii.53, 13.ix.53, 4.x.53 & 8.xi.53, by sweeping dry grassy area, *EWG* (24); 5.viii.69, 20.vii.69, 31.vii.69, 11.viii.69 & 21.ix.69, *PSB* (16); near Effingham, 25.viii.68, *PSB* (16); Oxshott Heath, 1922-25, associated with *Molinietum* in felled and burnt areas, *OWR* (61); 7.viii.1900, *AB* in *AJC* coll. (HD); 23.viii.03, *WW* (60); 27.v.11, *EAB* (BM); 25.v.19, *FJC* (60); 16.ix.50, *WJLeQ* (21); 4.viii.55, *EWG* (25); Esher Common, n.d., *JAP* (BM); 12.vii.52, *FJC* (1/1952-53: 84); 4.viii.55, adult and V & IV instar larvae, *EWG* (24); 19.ix.63, two brown examples, *AAA* (51); West End Common, 5.x.50, *FJC* (SL) (62); Arbrook Common, 8.vi.52, *FJC* (SL); Weybridge, 14.ix.69, *PSB* (16); and on the boundary at Byfleet, 25.vi.05, *ECB* (NM); 8.ix.13 & 9.vi.15, *EAB* (BM); 27.v.38, *FDB* (SL) (62); (Basingstoke Canal) 12.vii.02, swept from grass on canal side, *WJA* (38); 8.vii.50, along canal path, *DL* (1/1950-51: 73); Pyrford Heath, *FJC*

(62); Ripley, v.1896, *WJA* (SL); Wisley, 12.iv.48, *FJC* (SL); 30.viii.03, by sweeping, *WW* (60); and on Wisley Common, 11.viii.1899, *WW* (60); and beyond at Virginia Water, 22.viii.1894, *WW* (60); Chobham Common, 30.viii.36 & 1.ix.35, *ECB* (NM); vi.1892, *ES* (HD); 3.viii.15, *AJC* (HD); Horsell, 16.ix.31, *FJC* (SL) (60); 6.vi.31, *FJC* (SL) (1/1931–32: 64) (62); Woking, vi.1888 & viii.02, *ES* (HD); by the Basingstoke Canal between Pirbright Bridge and Frimley Green, 1954–55, *HDS* (50); Shere, *FJC* (62); Ewhurst, *FJC* (62); viii.1889 *EAB* (BM); Shalford, viii.1886, *EAB* (BM); Elstead, 8.v.38, *FDB* (SL) (62); Whitley, 30.v.32 ♂, *FJC* (SL) (62); and Dunsfold, 30.v.32 ♂, *FJC* (SL) (62).

BUCKS. On the boundary at Fulmer, 30.viii.53, *WJLeQ* (21); and Chalfont St Peter 15.vii.25 (adult & II instar) & 17.vii.25 (III & I instars *EAB* (BM)); and just over the boundary at Latimer, 21.iii.53, *WJLeQ* (21); Chesham, n.c. (26); Amersham, 18.viii.55, to light, *WJLeQ* (21); Slough (ICBFS), 3.v.33 & 6.xi.33, at roots of grass, *WHG* (41); (PILG) *GEW* (40); and beyond at Penn Wood, 7.ix.50, *WJLeQ* (21); and Hell Copse, 11.v.58, *GGES* (HD).

Stenodema trispinosum Reut.

Sp. 412 p. 304

Rare (but possibly overlooked). First recorded for the London Area by Groves in 1955 (see EMM 95: 113). This bug is associated with various grasses particularly creeping bent *Agrostis stolonifera*, and sedges such as the tufted sedge *Carex acuta*, growing in marshes especially near brackish water. The adults are to be found from July onwards and it is thought that in Britain the species may have two generations a year. So far it has been recorded only in Kent.

KENT. Erith Marshes 31.viii.55 an adult and V instar larva, *EWG* (24) (22); and beyond the boundary at Higham Marshes, 28.vii.66 two adults taken, *AAA* (51); and at High Halstow, 18.xi.61, *KCS* (14).

[SURREY. Mr Alan Stubbs reported (1/1967: 79) finding in May 1965 on Ockham Common an aberrant specimen of *Stenodema* having three spines on the right hind femur (characteristic of *S. trispinosum*) but with only two spines on the left hind femur (as in *S. calcaratum*). It is difficult to say what this could represent—E.W.G.]

Stenodema laevigatum (Linn.)

Sp. 413 p. 305

D & S p. 284 (*Miris laevigatus*)

S p. 221 (*M. laevigatus*)

B p. 355 (Sp. 253, *M. laevigatus*)

Common and widely distributed. This grass inhabiting mirid is often in association with *Stenodema calcaratum* although frequently found in damper situations. Pairing of the adults takes place soon after emergence in April from hibernation. The eggs are laid over a long period, from late May to early July, and take about two weeks to hatch. The larval stages last nearly four weeks so the first adults of the year's generation are not noticed until late July and the last become mature about mid-September.

MIDDX. Buckingham Palace grounds, 1961, a few adults found on lake-side vegetation, *TRES* (52); Hampstead Heath, 1949, *DL* (1/1949–50: 36–38); Highgate, 16.vi.1882, *EAN* (C); Highgate Wood, 3.vii.1890, by sweeping, *EAN* (C); Finchley, 18.iv.43, *CHA* (17); Mill Hill, 16.viii.58, *DL* (HD); Edgware (Scratch Wood), 15.viii.58, *DL* (54); Ruislip LNR, an overwintered ♂ & ♀ taken end of May (21.v.56, *EWG*) and a late ♀ in mid-June (19.vi.58, *EWG*); III & IV instar larvae swept in late June (27.vi.55, *EWG*); adult ♂♂ of the new generation taken from the end of July (29.vii.58, *EWG*) to September (9.ix.58, *EWG*), and new generation ♀♀ in August (9.viii.64, *RAPM*) and September (1.ix.55 & 9.ix.58, *EWG*) (49) (24); Northwood, 20.xi.43, *PJLR* (20); Harefield, 23.x.43, *PJLR* (20); 21.vi.52, *WJLeQ* (21); Ickenham Golf Course Nature Reserve, 30.v.54, *EWG* (25); and Hounslow Heath, n.d. *GEW* per *DL* (54).

HERTS. Barnet, viii.1885, *EAB* (BM); Boreham Wood, 18.ix.60, *DL* (HD) (54); Elstree, 22.vi.60, *DL* (HD) (54); Aldenham, 23.vii.61, *DL* (54); Rickmansworth, viii.16, V & III instar larvae, *EAB* (BM) (11); Chorley Wood, 27.v.63, *PSB* (16); Bricket Wood, 3.vii.56, *EWG* (25); Cuffley, 6.v.11, *EAB* (BM); and just over the boundary at Harpenden, 3. & 19.ix.54 and 20. & 21.ix.54, *GGES* (HD); and beyond at Royston 13.iv.14, *EAB* (BM); and Royston Heath, 31.vii.29, *GEH* (BM).

ESSEX. Ilford, v.1892, *ES* (HD); Woodford, 7.viii.25, adult & V instar larva *EAB* (BM); Chingford, 5.vi.15, 10.vi.11 & 18.vi.10, *EAB* (BM); Epping Forest (Loughton), viii.1891, iv.04, 10.ix.10 (adult & V instar larva) and 14.viii.25 (V & III instar larvae) *EAB* (BM); Epping Forest, 28.v.10, gravid ♀, *EAB* (38); generally distributed, by sweeping in grassy places, *CN* (35a); 7.x.62, *PSB* (16).

KENT. Brockley, *WW* (39); Blackheath, *AAA* (22); (garden at 63 Blackheath Park) the following observations were made in 1969: "common on 3.v.69 but no green ♀♀, by 13.v.69 the colour change of the ♀♀ was in full swing, all stages from brown to green noted; only 1 ♀ with complete winter colouring still; 15.vi.69 overwintered ♂♂ found about 15–20% of the total; by the end of the month this proportion was much reduced, nearly all being ♀♀; hibernating ♀♀ occasionally found at roots of herbage, etc., between autumn and spring; ♂♂ not so found; a single ♂ was seen flying actively low down amongst grass, etc., in cool sunless weather on 24.iii.67 and persisted in flight although knocked down two or three times; this species has not been taken at light"—*AAA* (51); (Shooters Hill), *AAA* (22); Charlton, *AAA* (22); Plumstead *AAA* (22); Plumstead Marsh, 1.x.1898, *WW* (60); Abbey Wood, *WW* (39); *AAA* (22); Lewisham, iv.1891, *AJC* (HD); Hither Green, 28.v.1900, in the little wood in the field near the railway, *WW* (60); Hither Green Lane, 18.vi.1900, *WW* (60); Lee, *D&S* (28); *WW* (39); Bexley, *D&S* (28) (39); Dartford, 17.ix.1890, *David Sharpe* in *EAN* coll. (C); Greenhithe, n.d. [prior to 1909], *FPP* (HD); Swanscombe, 12.vii.64, *PSB* (16); near Darenth, 8.vii.50, sweeping grass, *TRES* (13); Darenth, n.d. [prior to 1909], *FPP* (HD); Darenth, 4.vi.31, abundant in long grass, *FJC* (SL) (60) (1/1931–32: 64); Darenth Wood, 26.vi.54, *KCS* (14) (22); Birch Wood, n.d., *JAP* (BM); Longfield, 22.vii.52, *GGES* (HD); Fawkham, 24. & 26.ix.54, *GGES* (HD); Horton Kirby, 7.i.57 *KCS* (14); Farningham Wood, 9.v.65, *N. W. Iding* (1/1965: 86); 7.i.57, 10.iii.63, 17.iii.60, 2.iv.56, 21.vi.59 & 7.ix.68, *KCS* (22); Bromley, vi.1889, *ES* (HD); 7.ix.64, *PJC* (63); n.d. *HAS* (39); Beechen Wood, S. of Swanley, 4.viii.70, *KCS* (14); Downe (Darwin's Bank), 10.vi.67, *KCS* (14); Otford, *AAA* (22); Shoreham, 27.ii.60, 14.v.60 & 23.v.54, *KCS* (14) (22); near Westerham, 30.vi.68, *PSB* (16); Westerham, *AAA* (22); (Hosey Common), 17.vi.51, the green form, *SL* (1/1951–72: 72) (22); and on the boundary at Gravesend, 13.iv.46, under herbage, *TRES* (13); 22.vii.52, *GGES* (HD); Filboro' marshes, ix.47, on grass, *TRES* (13).

SURREY. Richmond Park, 20.x.41, *FJC* (60) (62); Wimbledon Common, 30.vi.55, *HDS* (60); 20.v.48 & 6.viii.41, *FJC* (SL) (62); Streatham, 26.vi.62, in rough grass *PSB*, (BM) (16); Purley, 10.iv.45, *JLH* (60); Purley Downs, 7.v.1893, *AJC* (HD); Shirley Common, *WW* per *FJC* (62); Warlingham, 22.vi.63, *KCS* (14); Banstead, 16.vi.1900, *SL* (1/1900: 14); Banstead Downs, 5.vii.57, II & III instar larvae, *EWG* (24); Banstead Heath, 3.ix.52, *PSB* (16); Coulsdon, 21.x.71, *KCS* (14); (Warwick Road) 12.v.61, by general sweeping at night, *HGD* (65); Farthing Downs, 24.v.63, on nettle, *HGD* (65); Chipstead, 16.iv.12, *EAB* (BM); Riddlesdown, 1.viii.53, V instar larva ♀, by sweeping long grass, *EWG* (24); Caterham, v.1872, *ES* (HD); (Pilgrim Fort) 21.ix.68, in grass on the scarp, *KCS* (14); Godstone, 22.vi.63, *KCS* (14); Limpsfield, 14.iii.45, *CHA* (17); Reigate [prior to 1867], by sweeping on Redstone Hill, *J&TL* (32); 3.ix.1898, by sweeping, *WW* (60) (62); 19.vi.16, *FJC* (60); Reigate Hill, 30.iii.51, under moss, *GBR* (45); Buckland Hill, 7.v.05 & 17.x.39, *ECB* (NM); Box Hill, 20.iv.1893, *AJC* (BM); *WW* per *FJC* (62); 18.vi.38, *FDB* (SL) (62); 12.iii.1899 & 13.iii.1898, *ECB* (NM in *ECB* register); 18.vi.39, *FJC* (60); 24.vi.51, *DL* (1/1951–52: xvi); Ranmore Common, 29.v.04, by sweeping, *WW* (SL); 18.vi.05, *WJA* (60) (SL); 27.viii.62, *PSB* (16); Mickleham, n.d., *JAP* (BM); 28.v.05 & 29.vi.11, *ECB* (NM); Epsom Common, 6.ix.53, V instar larva swept at edge of cultivated area, *EWG* (25); Ashted, 15.viii.46 & 11.vii.47, *FJC* (SL) (62); 25.ix.60, *SL* (1/1960: 95); Bookham Common, 18.ix.56, *FJC* (60); *WW* per *FJC* (62); vii., viii., & ix, *DL* (34); 19.vii.53, 9.viii.53 ♂♂ & 16.viii.53 (II instar larva), swept mainly from the drier grass areas, *EWG* (25); 19.vii.64, 31.vii.69 & 5.viii.69, *PSB* (16); Oxshott Heath, 30.vi.51, *FJC* (1/1951–52: 73); Arbrook Common, 26.v.52, *FJC* (SL); and Weybridge, 30.vi.63 & 14.ix.69, *PSB* (16). On the boundary near Effingham, 25.viii.68, *PSB* (16); Effingham, 25.vii.69 & 1.vi.68, *PSB* (16); East Horsley (Sheep Leas),

21.v.66, *AES* (1/1967: 84); Wisley Common, 26.ix.11, sweeping round the small lake, *WW* (60) (62); and Byfleet, 19.vi.15, *EAB* (BM); and beyond the boundary at Woking, vi.1888, *ES* (HD); by the Basingstoke Canal between Pirbright Bridge and Frimley Green, 1954-55, *HDS* (50); Guildford, 31.v.41, *ECB* (NM); Albury Down, 19.ix.31, *FJC* (60) (62); Ewhurst, *FJC* (62); and Chiddingfold, 1893, *HStJKD* (HD).

BUCKS. On the boundary at Chalfont St Peter, 15.vii.25, V & III instar larvae, *ECB* (BM); and Datchet, 3.vii.53, *GEW* (40). Just over the boundary near Amersham, 1902, abundant, *HJT* (1/1903: 66); South Heath, 15.x.50, *WJLeQ* (21); Hodgemoor Wood, 11.v.51, *WJLeQ* (21); and at Slough (ICBFS), 3. & 4.v.33, 7. & 17.v.33, & 24.v.33, on grass, *WHG* (41); and beyond at Coombe Hill, 7.vii.63, *PSB* (16); Hell Copse, 11.v.58, *GGES* (HD); and Hell Copse Lane, 27.v.23, *JJC* (HD).

Several varieties and forms of *Stenodema laevigatum* have been recognised, two of which have so far been recorded in the London Area:

var. *melas* Reut. (almost entirely black)

MIDDX. Northwood, 21.viii.16, *EAB* (38).

KENT. Bickley, 25.viii.01, *FBJ* (EMM 38: 224) (38).

SURREY. Chipstead, 26.viii.11, *ECB* (NM) (38).

forma *aestiva* Stichel

HERTS. Wormley Woods, 10.viii.41, *HWJ* (43).

Stenodema holsatum (Fab.)

Sp. 414 p. 306

D & S p. 283 (*Miris holsatus*)

S p. 221 (*M. holsatus*)

B p. 358 (Sp. 254, *M. holsatus*)

Rare. This species is common on upland pastures of the north of England and Scotland, becoming scarcer further south. In the London Area it has been found in only a few localities in Essex, Surrey and Bucks., associated with stands of the purple moor grass *Molinia caerulea* and to a lesser extent on other grasses, on damp heaths and in acid woodlands. The adults become mature in late July and early August.

ESSEX. Epping Forest, 22.ix.17, II instar larva, *EAB* (BM).

SURREY. Oxted, 11.vi.1893, *AJC* (HD); Upper Gatton, 19.ix.08, two specimens, *ECB* (NM); Headley Lane, ix., *D&S* (28); Box Hill, 27.viii.50, *DL* (1/1950-51: 77); Mickleham, *JAP* (BM); Oxshott Heath, 25.ix.15, *WJA* (SL); 1922-1925 associated with *Molinietum* in felled and burnt areas, *OWR* (61); West End Common, 22.vii.06, *WW* (60) (62); and beyond the boundary at Woking *GCC* (BM); Byfleet, 20.v.49 ♀ & 24.vi.49 ♀, *FJC* (SL) (62); and Ewhurst, viii.1889, a single example of the rare macrop-
terous ♀, *EAB* (38) (BM).

BUCKS. Just over the boundary at Slough (PILG), *WHG* per *GEW* (40); and beyond at Fingest near Marlow, 25.vii.59, in woods on grasses, *GEW* (40); and on the Chiltern Hills, viii.15, *EAB* (BM).

Notostira elongata (Geoff.)

Sp. 415 p. 306

D & S p. 287 (*Miris erraticus*)

S p. 223 (*Megaloceraea erratica*)

B p. 360 (Sp. 255, *M. erratica*)

Common and widely distributed. This mirid of grassy habitats has two generations a year—a summer and an autumn one. It is the females of the latter generation that, after fertilisation, survive through the winter. In spring they lay eggs on various species of grass and after hatching the larvae pass through the nymphal stages during May and June. Adults of the summer generation appear in June, building up to a peak in numbers by the first part of

July. Pairing begins at the end of June and the eggs are laid from then until mid-August. These hatch in July and the larvae of this second or autumn generation occur until the beginning of September, although the adults first appear in late August. After pairing the males die off and it is only the fertilised females that overwinter to continue the life cycle. Adult females of the two generations differ both in colour and size and at one time they were thought to be two separate species. The overwintering females assume an ochreous brown colour, and are somewhat smaller than those of the summer generation which always remain green.

MIDDX. Hampstead Heath, 15.v.43, *CHA* (17); 1949, *DL* (1/1949-50: 36-38); Finchley, 15.v.43, *CHA* (17); Hendon, 13. & 14.vi.59, on waste land with adults and larvae in equal proportions, *DL* (54) (EMM 97: 69); Edgware (Scratch Wood), 18.vii.60, 22. & 23.vii.60 and 28.vii.60, *DL* (56); 23.vii.60 *DL* (HD); Ruislip LNR, a common grass mirid that has two generations a year, instars and adults of the summer generation being recorded in June & July (IV, 18.vi.57, 19.vi.58; V, 18.vi.57, 27.vi.55 & 24.vii.56; and adults 27.vi.55 ♂ & 18.vi.57 ♀) and instars and adults of the autumn generation having been taken in September (V, 9.ix.58 & 19.ix.56; and adults ♂ & ♀ 9.ix.58)—all records of *EWG* (49) (25); Harefield, 19.vii.60, *DL* (HD) (54); Ealing, *JAP* (BM); and Hounslow Heath, 22.ix.52, *GEW* per *DL* (54).

HERTS. Barnet, viii.1885, *EAB* (BM); Boreham Wood, 18.ix.60, ♂♂, ♀♀ and larvae, *DL* (54) (HD); Elstree, 22.vi.60, *DL* (HD) (54); Aldenham, 23.vii.61, *DL* (HD) (54); Watford, 27.vi.60, *DL* (HD) (54); Chorley Wood, 13.i.52 & 18.iv.53, *WJLeQ* (21); Radlett, 20. & 26.vi.60, 28.vi.60 & 10.viii.58, adults and larvae (some parasitised), *DL* (54); (EMM 97: 67); 10.viii.58 & 26.vi.60, *DL* (HD); St Albans, 29.viii.64, *PLJR* (MM); Rye Meads, 1964, *BSN* (58); and just over the boundary at Harpenden, 3.vii.55, 5.vii.55 & 20.ix.54, *GGES* (HD); and beyond at Tring, 16.vii.41, ♂ & ♀, *FJC* (SL); and Royston, 20.v.18, *EAB* (BM).

ESSEX. Woodford, 29.viii.25, V instar *EAB* (BM); Chingford, 15.vii.11 & 8.x.10, *EAB* (BM); Epping Forest, 7.x.62, *PSB* (16); (Loughton) 14.viii.25, III & II instar larvae, *EAB* (BM); and beyond the boundary at Benfleet, 15.ix.57, *DL* (60); Canvey Island, 27.vi.14, *EAB* (BM); and Danbury, 18.vii.64, *PLJR* (MM).

KENT. Blackheath (in garden at 63 Blackheath Park), 28.ix.58, adults and 3 nymphs; 9.ix.61, a pair *in cop*; 20.ix.58, a ♂ with a gooseberry sawfly *Pteronidea ribesii* Scop. larva impaled on its rostrum, near a small gooseberry bush; 6.x.52 & 14.x.58, common, by sweeping grass; 21.x.66 two ♂♂ and on 15.x.66 more ♂♂—all records of *AAA* (51) (22); Charlton, *AAA* (22); Plumstead, 25.vi.55 ♀, *RGR* (WBM); *AAA* (22); Abbey Wood, 15.x.58, a few of both sexes, *AAA* (51); Abbey Wood marshes (Erith Marshes), 31.viii.55, adult and V, III & II instar larvae, *EWG* (24); *AAA* (22); Erith, 26.ix.57, *DL* (60); Lewisham, 3.x.1892 and x.1889, *AJC* (HD); *WW* (4) (22); Lee, *WW* (4) (22); Kidbrooke, 15.ix.1894, sweeping in the swamp, *WW* (SL) (60) (4) (22); 31.viii.1895, *WW* (60); Kidbrooke Lane, 4.viii.1894, by sweeping grass, *WW* (60); 6.vii.1895, *WW* (SL); Ruxley, 3.i.65, in grass tuft, *KCS* (14); Dartford, 17.ix.1890, *David Sharpe* in *EAN* coll. (C); Swanscombe, 12.vii.64, *PSB* (16); Birch Wood, *JAP* (BM); Darenth Wood, 1890's, *AJC* (HD); 9.iv.49, by sweeping herbage, *TRES* (13); *AAA* (22); Fawkham, 15.ix.53, *GGES* (HD); Farningham Wood, 21.vi.59, *KCS* (14); *AAA* (22); Bromley, vii.1887, *ES* (HD); Downe, 2.ix.64, *PJC* (63); Otford, *AAA* (22); Kingsdown, 28.viii.24, adult (teneral) & III instar larva, *EAB* (BM); Magpie Bottom, 9.vii.55, *KCS* (14) (22). On the boundary at Gravesend, *JAP* (BM); and just over at Trottiscliffe, *KCS* (22); and beyond that at Port Victoria, Isle of Grain, 26.ix.54, *GGES* (HD).

SURREY. Norwood, *JAP* (BM); Richmond Park, *FJC* (62); Wimbledon Common, 20.vi.1897 & 7.vii.1897, on grasses near the windmill, *EAN* (C); 3.viii.12 ♂, *FJC* (60) (62); Cheam (Nonsuch Park), 22.vii.55, III instar larva, *EWG* (24); Purley *JAP* (BM); Banstead Heath, 3.ix.62, *PSB* (16); Chipstead, *FDB* per *FJC* (62); Riddlesdown, 20.vi.53, V instar larva, *EWG* (24); Caterham (Pilgrim Fort), 21.ix.68, in grass on the scarp, *KCS* (14); Reigate, *GBR* per *FJC* (62); Box Hill, 23.vii.32, *FJC* (SL); 15.ix.34 ♂, *FJC* (60) (62); 18.ix.57, *AAA* (51); v.55, along banks of the River Mole, *JHPS* (EMM 92: 132); Norbury Park, 19.vii.52, adult & nymph, *EWG* (24); Mickleham, ix.08 ♀,

WJA (60); Epsom Common, 6.ix.53, ♂♂ and V instar larva, *EWG* (24); Ashted, 10.vii.46, 11.vii.47 ♂ & 15.viii.46 ♀, *FJC* (SL); 2.x.39 ♂, 15.viii.46 ♂, 3.ix.49 ♀, & 14.ix.47 ♀, *FJC* (60) (62); Leatherhead, *FJC* (62); 16.iii.24 ♀ & 21.iv.25 ♀ *WEC* (BM); Bookham Common, 18.ix.36 ♂, *FJC* (60) (62); 29.vii.50, *DL* (1/1950–51: 76); 8.v.55 ♀, 21.vi.55 (IV instar), 19.vii.53 (adult summer form and V, IV & III instars), 10.viii.58 (IV instar), 12.viii.56 (V instar), 16.viii.53 (adult ♂♂ & ♀♀ and V & IV instars), 27.viii.55 (V instar), 13.ix.53 (adult ♂ & ♀ *in cop.*), 4.x.53 (adult ♂♂ & ♀♀), 12.x.52 (a single ♂ seen flying strongly over dried up bed of IOW pond) and 8.xi.53 (adult ♂♂ & ♀♀)—all records of *EWG* (24); 20.vii.69, 31.vii.69, 9.viii.66, 9.viii.69, 11.viii.69 & 1.ix.69, *PSB* (16); Oxshott Heath, 27.v.11, *EAB* (BM); 23.x.15 ♀, on grass, *FJC* (60) (62); Esher Common, 12.vii.52, *FJC* (1/1952–53: 84); West End Common, 11.ix.50 ♂ & 20.viii.51, *FJC* (60); Arbrook Common, 30.vi.52, *FJC* (SL); and Weybridge, *JAP* (BM); 30.vi.63 & 14.ix.69, *PSB* (16). On the boundary at Effingham, 25.viii.68, *PSB* (16); and Byfleet, 3.viii.1892, *AJC* (HD); (Basingstoke Canal), 8.vii.50, along the canal path, *DL* (1/1950–51: 73); and beyond at Virginia Water, 22.viii.1894, sweeping on the common, *WW* (60); Woking, viii.1888 & ix.1888, *ES* (HD); n.d. [but prior to 1909], *FPP* (HD); by the Basingstoke Canal between Pirbright Bridge and Frimley Green, 1954–55, *HDS* (50); Gomshall 19.ix.10, *EAB* (BM); Guildford, 22.vii.43 ♀, *ECB* (NM); Albury, *FJC* (62); and Leith Hill, viii.1895, *EAB* (BM).

BUCKS. Just over the boundary at Latimer, 5.ix.50, *WJLeQ* (21); Chesham Vale, 5.vii.52, *WJLeQ*, Amersham, 3.v.53 & 6.vii.52, *WJLeQ* (21); and Slough (ICBFS), 23. & 26.vi.34, on grass, *WHG* (41); and beyond at Coombe Hill, 23.vi.63, *PSB* (16); and the Chiltern Hills, viii.15, adult & III instar, *EAB* (BM).

Megaloceroea relicticornis (Geoff.)

Sp. 416 p. 308

D & S p. 289 (*Miris longicornis*)

S p. 223 (*Megaloceraea longicornis*)

B p. 362 (Sp. 256, *M. linearis*)

Local, though sometimes common in a few localities particularly since 1960 (*fide* A. A. Allen—see below). This large, thin bug with long antennae occur from July to September on various grasses, particularly slender false-brome *Brachypodium sylvaticum*. It may be searched for on damp commons, in fields and pastures, and at the margins of woods especially where the grass grows long or is left uncut.

MIDDX. Edgware (Scratch Wood), 22.vii.60, *DL* (HD); Ruislip LNR, adults have been taken from the end of July (24.vii.56, 29.vii.55 & 29.vii.58) but III, IV & V instars often found overlapping in June & July (e.g. III & IV (18.vi.57); IV (19.vi.58); III, IV & V (27.vi.55 and 24.vii.56))—all records are of *EWG* (49) (25).

HERTS. Barnet, viii.1885, *EAB* (BM); *ES* (37); Rickmansworth, viii.16, *EAB* (BM); Radlett, 26.vi.60, adults (some teneral), *DL* (54); Bricket Wood Common, 3.vii.56, IV & III instar larvae, *EWG* (24); Rye Meads, 1964, *BSN* (58); and just over the boundary at Harpenden, 8.viii.37, *DCT* (12); 29.vii.55, *GGES* (HD); and beyond at Royston, 18.v.18, II instar *EAB* (BM); and Wymondley, *ES* (37).

ESSEX. Stanford le Hope, 28.vii.54, *KCS* (14).

KENT. Allen (*pers. comm.*) comments that this species “was apparently very local and restricted in N.W. Kent and the London Area up to about the 1950s. Thus by 1960 I had only once met with it viz. Westerham (Squerries Park), 24.vii.60 in a very limited area under a group of trees. But soon after that it became very much commoner and turned up in plenty in localities where, for the previous few years at least, it had been absent or very scarce”; Blackheath (garden at 63 Blackheath Park), 1.viii.61, a single specimen, *AAA* (51) (22); Abbey Wood, 12.vii.63, common but local, *AAA* (51) (22); Lee, *D&S* (28) (4) (39) (22); Birdbrook, *JAP* (BM); Bexley, *D&S* (28) (4) (39) (22); Dartford, *D&S* (28) (4) (39) (22); Dartford Marshes area, 7.vii.66, local, *AAA* (51); Fawkham, 29.vi.50, *GGES* (HD); Hayes Common, 13.ix.36 ♂, *D. W. Royffe* (SL); Otford Downs, 20.vii.61, common and widespread over the downs both in the open and, more especially

under trees, none seen at same place on 16.vii.65, *AAA* (51) (22); Westerham (Squerries Park) (see note above); on the boundary at Gravesend, 22.vii.52, *GGES* (HD); and beyond, at Trottiscliffe, *KCS* (22); Shorne, 30.vii.62, *KCS* (14) (22); and at Chattenden, 4.vii.59, *AMM* in *PJLR* coll. (MM).

SURREY. Richmond Park, 6.x.41, *FJC* (SL); Surbiton, viii.1892, *ES* (HD); Chipstead, 21.vii.12, *ECB* (NM in *ECB* register); 30.vii.38 ♀, *FDB* in *FJC* coll. (SL); Reigate, vii. & viii., by sweeping *GBR* per *FJC* (45) (62); Headley Lane, 2.viii.1897, *WW* (60) (62); Box Hill, 9.viii.1895, *WW* (60); 16.vi.17, II instar, *EAB* (BM) (3) (37); 17.vii.38 & 10.viii.35, *ECB* (NM); 1.viii.62, "about the commonest bug everywhere", *AAA*, (51); *FJC* (62); Mickleham, *D&S* (28); *JAP* (BM); *EAB* (3) (37); *FJC* (62); 9.vii.05, *ECB* (NM); Ashted, 9.v.47 ♀, 10.vii.48, 11.vii.47, 14.ix.47 & 2.x.39, *FJC* (SL) (62); Leatherhead, 22.vii.24, *FJC* (SL) (60); Bookham Common, 6.viii.1895, *WW* (60) (62); 15.viii.49 & 18.ix.30, *FJC* (SL); 29.vii.50, *DL* (1/1950–51: 76); 16.viii.53 (adult ♀♀ and V and IV instar larvae) and 19.vii.53 (V & IV instar larvae), *EWG* (24); 25.vii.64, 9.viii.66 & 4.ix.65, *PSB* (16); Oxshott Heath, 23.x.15, *WJA* (SL); 11.vii.52 ♂, *FJC* (SL); West End Common, 11.ix.50 ♂ & ♀ and 25.ix.50 ♀, *FJC* (SL); and Arbrook Common, 28.vi.48 ♀, *FJC* (SL). On the boundary near Effingham, 25.viii.68, *PSB* (16); and at Effingham, 22.vii.49, *FJC* (SL) (62); and beyond at Abinger, viii.04, *EAB* (BM); Gomshall, 4.viii.33, *FJC* (SL); *EAB* (3); Shere, ix.1892, *EAB* (BM) (3); Clandon, viii.1900, *ES* (HD) (3); Guildford, 5.vii.43 & 12.vii.44, *ECB* (NM); Albury, 12.v.34 ♀, *FJC* (SL); and Shalford, *EAB* (3) (37).

BUCKS. Beyond the boundary at Burnham Beeches, 31.vii.54, *WJLeQ* (21); Little Missenden, 13.vii.52, *WJLeQ* (21); and in the Chiltern Hills, viii.15, *EAB* (BM).

Trigonotylus ruficornis (Geoff.)

Sp. 418 p. 308

D & S p. 290 (*Miris ruficornis*)

S p. 224 (*Megaloceraea ruficornis*)

B p. 363 (Sp. 257, *M. ruficornis*)

Frequent. It occurs on the drier parts of commons, heaths, and dry grassy places, where the adults are found from June to October. Grasses with which this species is particularly associated include the common bent *Agrostis tenuis*, wavy hair grass *Deschampsia flexuosa*, red fescue *Festuca rubra* and timothy *Phleum pratense*. This bug overwinters in the egg stage.

MIDDX. Hampstead Heath, 1949, not common, *DL* (1/1949–50: 36–38); 5.viii.60, *DL* (HD) (54); Mill Hill, 15.viii.60, *DL* (HD); Edgware (Scratch Wood), 10.vii.48, *CHA* (17); 15.viii.58, *DL* (54); 28.vii.60, *DL* (HD) (54); Ruislip LNR, adults and larvae fairly common in August both on *Carex flacca* (9.viii.64, *RAPM*) and on *Phalaris arundinacea* (16.viii.64, *RAPM*); Hounslow Heath, 26.vii.53, *WJLeQ* (21); 22.ix.52, *GEW* per *DL* (54).

HERTS. Whetstone, 1.viii.60 ♂ taken in MV light trap, *PHW* (*pers. comm.*) (47); Barnet, viii.1885, *EAB* (BM); Elstree, 22.vi.60, *DL* (HD) (54); Bushey, 25.vii.43, *CHA* (17); Radlett, 20.vi.60, adults & V instar larvae (some parasitised), *DL* (EMM 97: 69) (HD) (54); and Chorley Wood, *EAB* (11); and just over the boundary at Harpenden, 1934–36, 7 ♂♂ (but no ♀♀) taken in light trap in Rothamsted Expt. Station grounds, *DCT* (59); 1.viii.54, *GGES* (HD).

ESSEX. Epping Forest, generally distributed, by sweeping in grassy places, *CN* (35a); 16.ix.63, *PSB* (16); 8.viii.64, *PJLR* (MM); (Chingford) vii.1891 (adult) & 14.vi.13 (III instar), *EAB* (BM); and Theydon Bois, vii.22, *EAB* (BM).

KENT. Blackheath (garden of 63 Blackheath Park), not common, 18.vi.59, 28.viii.63, 5.xi.63, etc., swept from garden lawn, *AAA* (51); also taken at light on the following dates, 3. & 8.vii.59, 15. & 17.vii.59, 5. & 20.vi.60, 19.vi.60 (three specimens excessively active), *AAA* (51) (22); Charlton, vi. & vii., amongst grass, etc., *D&S* (28) (4) (39) (22); *AAA* (22); Plumstead, 17. & 20.ix.57, in some numbers under overhanging orache *Atriplex* sp. at edge of sandpit, *AAA* (51) (22); Lee, *WW* (4) (22); Kidbrooke, 23.vii.1898, 6.viii.1898, & 31.viii.1895, by sweeping, *WW* (60) (4) (22); Kidbrooke Lane, 6.vii.1895,

WW (60); Dartford, 13.ix.1890, *David Sharpe* in *EAN* coll. (C); vi. & vii., amongst grass, etc., *D&S* (28) (4) (39) (22); Swanscombe Skull site, 12.vii.64, *PSB* (16); Birch Wood, *JAP* (BM); Westerham, 24.vii.60, rather common, *AAA* (51); and on the boundary at Sevenoaks (Knole Park), 27.vii.63, *KCS* (14) (48); and beyond at Higham, 14.vii.63, *KCS* (14).

SURREY. Wimbledon Common, 20.vi.1897 & 7.vii.1897, on grasses near the wind-mill, *EAN* (C); 2.vii.48, *FJC* (SL) (62); Surbiton, vii.92, *ES* (HD); Reigate, *GBR* per *FJC* (62); Walton Heath, vii., 1949–1953, in bracken/heath, *GBR* (45); Headley, 6.ix.64, *KCS* (14); Box Hill, viii.1888, *EAB* (BM); 24.vi.51, *DL* (1/1951–52: xvi); Ashted, 10.vii.48, 19.vii.47, 15.viii.46 & 14.ix.47, *FJC* (SL) (62); Bookham Common, 6.viii.1895, by sweeping, *WW* (60) (62); 10.vii.55 & 9.viii.53 ♀, *EWG* (24); vii. & viii., *DL* (34); Oxshott Heath, 1922–25, associated with the *Molinietum* and *Juncetum* in felled and burnt areas, *OWR* (61); Esher Common, 12.vii.52, common, *FJC* (1/1952–53: 84); and West End Common, 25.v.51 & 13.viii.51, *FJC* (SL). On the boundary at Egham, 10.vii.54, *GEW* (40); Ripley, viii.1900, *EAB* (BM); Wisley Common, *WW* per *FJC* (62); Byfleet, 19.vi.15, II instar *EAB* (BM); and beyond at Chobham Common, 19.ix.13, *ECB* (NM); Woking, vi.1888, *ES* (HD); by the Basingstoke Canal between Pirbright Bridge and Frimley Green, 1954–55, *HDS* (50); Blackheath, south of Chilworth Station, 12.v.34, common, *FJC* (1/1934–35: 13); Guildford, 22.vii.43 ♀, *ECB* (NM); and Ewhurst, viii.1890, *EAB* (BM).

BUCKS. Just over the boundary at Stoke Common, 18.vii.53, *WJLeQ* (21); and Hawridge Common, W.N.W. of Chesham, 23.vi.61, *WJLeQ* (21); and beyond at Penn Wood, 1.vii.51, *WJLeQ* (21); and Ivinghoe, 8.vii.59, *WJLeQ* (21).

Teratocoris antennatus (Boh.)

Sp. 419 p. 309

S p. 225

B p. 365 (Sp. 260)

Rare. As this bug, which occurs from July to October, is found mainly on brackish marshes and swamps near the coast, most of its habitats are just outside the LNHS boundary. However there have been a few inland records in the London Area where the species was associated with tufts of rush *Juncus* sp. and the flote-grass *Glyceria fluitans*. In coastal areas sea club-rush *Scirpus maritimus* is probably its main food plant. It overwinters in the egg stage.

MIDDX. Hounslow Heath, 26.vii.52, beaten in some numbers from large tufts of *Juncus* growing by the pond (dried up), *GEW* (33b); 5.v.53, a macropterous ♀ swept from the heath area, *GEW* (33c).

KENT. On the boundary at Milton, near Gravesend, n.d., *WW* (1/1911–12: 52); and beyond at Sheppey *GCC* (37) (22).

SURREY. Reigate, *ES* (3) (36) (37); Esher Common, 22. & 27.vii.64, a few swept from rushes by the Black Pond in company with *Cyrtorhinus caricis*, *AAA* (51).

BUCKS. Just over the boundary at Slough, 18.viii.54, V instar larvae occurring sparingly in a reed bed about 0.5 mile S. of Slough, *GEW* (EMM 91: 36); 4.vii.59, on sedges, *GEW* (40); and beyond at Halton, near Wendover, 18.viii.57, *WJLeQ* (21).

Teratocoris saundersii D & S

Sp. 421 p. 310

S p. 226

B p. 367 (Sp. 262)

Rare. This species, like the last, also occurs in coastal marshes, more rarely inland, and at present there are only two London records. Adults are to be found on various species of *Juncus* from July to October and, though more usually brachypterous, an occasional fully developed form may be found. Like the previous species it overwinters in the egg stage.

ESSEX. Purfleet, *RML* (5) (*Entomologist* 28: 312).

BUCKS. Just beyond the boundary at Slough, 2.viii.58, 1 ♂ and 9 ♀♀ taken in a swamp, *GEW* (EMM 95: 6); 4.vii.59, on sedges, *GEW* (41).

Leptopterna ferrugata (Fall.)

Sp. 422 p. 311

D & S p. 295 (*Lopomorphus ferrugatus*)

S p. 227

B p. 369 (Sp. 263)

Common and widespread. The adults are found from July until the end of August on commons, heaths, grassy hillsides, and waste places throughout the London Area, though preferring drier situations than the next species with which it may sometimes occur. It is found feeding on various grasses of which common bent *Agrostis tenuis*, oat grass *Arrhenatherum elatius*, wavy hair-grass *Deschampsia flexuosa*, red fescue *Festuca rubra*, and meadow grass *Poa pratensis* seem the more favoured.

MIDDX. Edgware (Scratch Wood), 10.vii.48, *CHA* (17); and Hounslow Heath, 19.vii.52, several specimens taken in company with large numbers of *L. dolabrata* by sweeping the drier, grassy parts of the swamp, *GEW* (33b) (54).

HERTS. "Common on exposed chalk hills", *DCT* (12); Elstree, 22.vi.60, *DL* (HD) (54); Chorley Wood, *EAB* (11); and just over the boundary at Harpenden, 27.vi.55 & 12.vii.55, *GGES* (HD); and beyond at Tring, 17.vi.33, *DCT* (12); Wymondley, viii.1880 ♀ brachypterous, *EAB* (BM); and Royston, 7.vi.19 (IV instar) & 26.v.17 (II instar) *EAB* (BM).

ESSEX. Ilford, vii.1888, *ES* (BM); and beyond the boundary at Benfleet, 17.v.19 (I instar) *EAB* (BM).

KENT. Charlton, 9.vii.58, common in dry field, *AAA* (51) (22); Abbey Wood, 18.vi.58, common, *AAA* (51) (22); Abbey Wood marshes (Erith Marshes), *AAA* (22); Kidbrooke, 1901 *WW* (4) (39) (22); Eltham, *D&S* (28) (4) (22); Darenth, 14.v.1893, *AJC* (HD); Birch Wood, *JAP* (BM); Otford Downs, 20.vii.61 & 16.vii.65, a few, *AAA* (51); Shoreham, *AMM* (22); Brasted, 10.vii.22 ♂ & ♀, *PH* (BM); and Westerham (Squerries Park) 24.vii.60, one ♂, *AAA* (51); and beyond the boundary at High Halstow (nature reserve), 13.vi.59, a colony, *AAA* (51).

SURREY. Wimbledon Common, 20.vi.1897 & 7.vii.1897, on grasses near the windmill, *EAN* (C); Wimbledon, 25.vi.1892, *EAN* (C); Reigate, *WW* per *FJC* (62) (SL); vii.1949–53, sweeping on downland, *GBR* (45); Box Hill, viii.1882 ♀ brachypterous, & viii.1888 ♂ macropterous *EAB* (BM); 13.vi.49, *FJC* (SL); *WW* per *FJC* (62); 21.vii.51, *SL* (1/1951–52: 76); Mickleham, 1.vii.06, *ECB* (NM); Leatherhead, 22.vii.24 ♀ brachypterous, *FJC* (SL) (62); Bookham Common, 29.vi.18, by sweeping *WJA* (SL); vii., *DL* (34); Oxshott Heath, 16.vii.1899, *ECB* (NM); 30.vi.51, *FJC* (1/1951–52: 73); 15.vi.58, V instar larva, *EWG* (24); (Sandy Lane), 11.vii.52, *FJC* (SL); Esher Common, *JAP* (BM); Weybridge, *JAP* (BM); vii., *D&S* (28); and on the boundary at Byfleet, 25.vi.05, *ECB* (NM); and beyond at Chobham Common, vii.1892, *ES* (HD); Woking, vii.1890, *ES* (HD); by the Basingstoke Canal between Pirbright Bridge and Frimley Green, 1954–55, *HDS* (50); Gomshall, 8.vii.51, *HDS* (SL); Guildford, 2. & 7.vii.43 and 16. & 22.vii.43, *ECB* (NM); and on Hindhead Common, 13.vii.63, *PSB* (16).

BUCKS. On the boundary at Chalfont St Peter, 15.vii.25, ♀ brachypterous & ♀ macropterous, *EAB* (BM); and just over at Hedgerley, 25.vi.55, *GEW* (40); and beyond at Coombe Hill, 7.vii.63, *PSB* (16).

Leptopterna dolabrata (Linn.)

MEADOW PLANT BUG

Sp. 423 p. 311

D & S p. 294 (*Lopomorphus carinatus*) and p. 297 (*L. dolabratus*)

S p. 227

B p. 371 (Sp. 264)

Abundant and widespread. It occurs on commons, heaths, and roadside verges and in meadows and riverside pastures, wherever the grass is damp and lush. It is confined to grasses of which couch grass *Agropyron repens*, cocksfoot *Dactylis glomerata*, meadow foxtail *Alopecurus pratensis* and timothy *Phleum pratense* form the principal food plants. Adults become mature from mid-June with a build up in numbers until the end of July (see below, under Bookham

Common, Surrey, for a summary of a study on the instars). Although the females seem to live longer than the males, few have been found to survive later than the middle of August. The males are always macropterous while in the females the brachypterous state is the more usual, although an occasional fully winged specimen may be encountered.

MIDDX. Hampstead, 1.vii.1882, *EAN* (C); Highgate, *D&S* (28); vi.1893 ♂ *EAB* (BM); Finchley, 13.vi.43, *CHA* (17); Ruislip LNR, I & II instars have been taken in May (21.v.56), III, IV & V instars from end of May until the end of June (III, 21.v.56, 18.vi.56 & 19.vi.58; IV, 18.vi.57 & 19.vi.58; & V, 18.vi.57, 19.vi.58 & 27.vi.55) and adults from mid-June until the end of July (18.vi.57, 19.vi.58, 27.vi.55, 24.vii.56, 29.vii.56 & 29.vii.58)—all records of *EWG* (49) (25); Northwood, 14.vi.60, abundant larvae and a few early adults, *DL* (54); and Hounslow Heath, 19.vii.52, *GEW* per *DL* (54).

HERTS. Barnet, viii.1885 ♂, *EAB* (BM); Elstree, 22.vi.60, *DL* (HD) (54); Aldenham, 23.vii.61, *DL* (HD) (54); Radlett, 20.vi.60, *DL* (HD) (54); 26.vi.60, adults & V instar, *DL* (54); Rye Meads, 1964, *BSN* (58); and on the boundary at Harpenden, 1933–36, taken in light trap in Rothamsted Expt. Station grounds, *DCT* (59); 5.vii.55, 13.vii.54 & 12.vii.55, *GGES* (HD); Wheathampstead, 30.v.60, V & IV instar larvae (some parasitised) *DL* (54); and beyond at Tring, 16.vii.41 ♂ & ♀, *FJC* (SL); Wymondley, viii.1880, ♀ brachypterous, *EAB* (BM); and Royston, 29.v.17 (I instar) & 30.v.14 (II instar), *EAB* (BM).

ESSEX. Ilford, vii.1888, *ES* (HD); Hale End, vi.19, *CN* (35a); Chingford, vii.1867 & vii.1892, ♀ macropterous, *EAB* (BM); 18.vi.10, III instar, *EAB* (BM); 10.vi.11, III & II instar larvae, *EAB* (BM); Epping Forest (Fairmead), *CN* (35a); Theydon Bois, vii.22 ♀ brachypterous, *EAB* (BM); and beyond the boundary at Benfleet, 17.v.19, I instar larva, *EAB* (BM); and Danbury, 18.vii.64, *PLJR* (MM).

KENT. Blackheath (garden at 63 Blackheath Park), ♂♂ occasionally in garden, 9.vii.68, 14.vii.68 and one about 1963, *AAA* (51); (Shooters Hill) *WW* (4) (39) (22); Abbey Wood, 18.vi.58, *AAA* (51); *WW* (39); Abbey Wood marshes (Erith Marshes), *AAA* (22); Upper Belvedere, 18.viii.60, nymph, *RGR* (WBM); Lee, *JAP* (BM); *D&S* (28) (4) (39) (22); *WW* (39); Kidbrooke, *WW* (4) (39) (22); Eltham, *D&S* (28) (4) (39) (22); Swanscombe, 12.vii.64, *PSB* (16); Darenth Wood, 8.vii.1900, *ECB* (NM, in *ECB* register); Horton Kirby, 23.vi.62, *KCS* (14) (22); Farningham Wood, 5.vii.65, *KCS* (14); Bromley, vii.1887, *ES* (HD); 29.vi.66, *PJC* (63); Beechen Wood, S. of Swanley, 4.vii.70, *KCS* (14); Orpington, 29.v.36 ♀ & 16.vi.35, III instar *E. Gowing-Scopes* (65); Otford, 16.vii.65 ♂, in chalkpit near the station, *AAA* (51); Shoreham, 19.vi.60 & 17.vii.60, *KCS* (14) (22); Magpie Bottom, 25.vi.61, *KCS* (14); Westerham (Squerries Park), 24.vii.60, several, *AAA* (51); and beyond the boundary at Halling Downs, 29.vi.58, a ♂ swept from clover *Trifolium* sp., *AAA* (51).

SURREY. Wimbledon Common, 20.vi.1897 & 7.vii.1897, on grasses near the windmill, *EAN* (C); 25.vi.55 adults and IV instar, *EWG* (24); *WW* per *FJC* (62); Wimbledon, vii.1882, on nettle, *EAN* (C); Putney, 5.vii.1889, *EAN* (C); Cheam (Nonsuch Park), 8.vii.55 ♂ & 13.viii.54 ♀, *EWG* (24); Shirley Common, 25.ix.1897, *WW* (SL) (62); Old Coulsdon (Happy Valley), 4.vii.54, adult and V, IV & III instars, *EWG* (24); Godstone, 22.vi.63, *KCS* (48); Oxted, 11.vi.1893, *AJC* (HD); Gatton Park, 25.vi.49 ♀, by sweeping, *GBR* (45); Reigate [prior to 1867], by sweeping, *J&TL* (32); *WW* per *FJC* (62); *GBR* (45); Redhill [prior to 1867], by sweeping *J&TL* (32); Box Hill, 25.vii.63, *AAA* (51); 24.vi.51, *DL* (1/1951–52: xvi); *FJC* (62); Ranmore Common, *WW* per *FJC* (62); Epsom Common, 1.viii.36, *FJC* (SL) (62); Ashted, 5.vii.41 & 15.vi.48, *FJC* (SL); 14.vii.47, *FJC* (65) (62); Leatherhead, *FJC* (62); Bookham Common, 6.vii.35, *FJC* (SL) (62); considerable overlap of instars was noted during a five-year study of grass areas on Bookham Common: the earliest I instar was found in May (13.v.56) with II instars also in the same month (8.v.55 & 13.v.56); III instars were noted from May to June (11.v.58, 23.v.53, 16.vi.57 & 21.vi.55); IV & V instars were present together from the third week in May lasting about one month (20.v.57 (V), 23.v.53 (IV), 16.vi.57 (IV & V), 21.vi.55 (IV & V) & 14.vii.58 (IV)); from mid-June adults were noted until the third week of July (21.vi.55 & 19.vii.53)—all records of *EWG* (23); vi., *DL* (34); 8.vii.51, *DGH* (57); 19.vii.64, 20.vii.69, 31.vii.69 & 5.viii.69, *PSB* (16); Oxshott Heath, 27.v.11, II instar, *EAB* (BM); 16.vii.1899, *ECB* (NM in *ECB* register); 31.vii.15, *WJA* (SL); 30.vi.51, *FJC* (1/1951–52:

73); Esher, *JAP* (BM); Arbrook Common, 8.vi.52, *FJC* (SL); 16.vi.52 ♂, *FJC* (65); and Weybridge, 21.vi.13, III instar, *EAB* (BM); *D&S* (28) (62). On the boundary at East Horsley, 7.vii.1900, *SL* (1/1900: 16); and Byfleet, *FJC* (62); and beyond the boundary at Chobham Common, vii.1892, *ES* (HD); by the Basingstoke Canal between Pirbright Bridge and Frimley Green, 1954–55, *HDS* (50); Abinger Hammer, 11.v.12, I instar, *EAB* (BM); Guildford, 28.vi.43, 2.vii.43, 5.vii.43 & 28.vi.41, *ECB* (NM); and Milford, 13.vii.63, *PSB* (16).

BUCKS. Just over the boundary at Hedgerley, 25.vi.55, *GEW* (40); and Slough (ICBFS), 7. & 9.vi.33 on *Plantago lanceolata* and grass, *WHG* (4); (PILG) *GEW* (40); and beyond at Coombe Hill, 7.vii.63, *PSB* (16).

(End of Part XI)

Observations on the Fauna of the Metropolitan River Thames During the Drought in 1976

by M. J. ANDREWS*

Summary

The 1976 drought and associated low upland flow of water in the River Thames permitted increased salt-water penetration from the mouth of the estuary into the tidal part of the river through London. Marine and estuarine animals took advantage of the increased salinity of the metropolitan Thames to extend their range of upriver penetration, so that in many areas the river fauna underwent a marked change. Another important factor influencing the faunal distribution, especially in the mud reaches from Woolwich to Dagenham, was the improved effluent from the recently extended Beckton Sewage Works in Barking Reach. The following is an account of some of the qualitative and quantitative changes in fauna that occurred in the urban river in 1976, compared with those previous years for which information is available. The results show that the major factor restricting marine fauna in London is low salinity, not pollution as has been the case for so long in the past. The general river water quality remained good throughout the year despite the drought and restriction and removal of all flow over Teddington Weir during the late summer.

Introduction

Early in 1976 routine biological surveys of the fauna of the urban River Thames showed that considerable changes were occurring to the extent that, by summer, typically brackish water animals were found in the very centre of London, where previously only freshwater organisms had been collected. Table 1 shows the observed change in macro-invertebrate populations at Bankside (—1)†, just above London Bridge (0) (Fig. 1). Most of the listed large invertebrates were found intertidally, but a few were taken at the water's edge at low water, and it may be seen that within the space of about one year freshwater organisms were replaced by marine and estuarine species. These major changes in the fauna were of course linked closely with changes occurring in the river water, and in particular the water salinity and its dissolved oxygen content.

Water Salinity in 1976

Rainfall in the Thames catchment area in the twelve month period ending in September 1976 ranks lowest since 1727 when records first were available. The associated low upland flow of water over Teddington Weir resulted in increased sea-water penetration into the tide-way. After correction to half-tide conditions the upper limit of this saline intrusion (indicated conventionally by the location where the chlorion is 100mg/l) was shown to be above Richmond (—26) compared with its position at Brentford (—22) in 1975, and at high tide on occasions reached Eel Pie Island (—31), only 1 km below the tidal limit at Teddington (—32). That saline intrusion should be so marked was partly due to the introduction of "tail to head" pumping at Molesey and Teddington Locks

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† Figures in parentheses preceded by a minus sign indicate the distance in km *above* London Bridge (Fig. 1); a plus sign indicates the distance *downriver* from this point.

from late July to September in order to minimise navigational (lockage) and structural leakage, and thus enabling the maximum amount of water to be abstracted by the Metropolitan Water Division with minimal loss to the tidal reach below Teddington.

TABLE 1. Collected macro-invertebrates from the River Thames at Bankside (—1), just above London Bridge.

25 June 1975

2 August 1976

CRUSTACEA

Acanthocyclops americanus
Cyclops agilis speratus
Cyclops vicinus
Asellus aquaticus
Crangonyx pseudogracilis
Gammarus pulex

Eurytemora affinis
Crangon crangon
Gammarus salinus
Neomysis integer
Palaemon longirostris
Sphaeroma rugicauda

EPHEMEROPTERA

Caenis moesta

HIRUDINEA

Erpobdella octoculata
Glossiphonia heteroclita

MOLLUSCA

Dreissena polymorpha
Lymnaea peregra
Physa fontinalis
Potamopyrgus jenkinsi

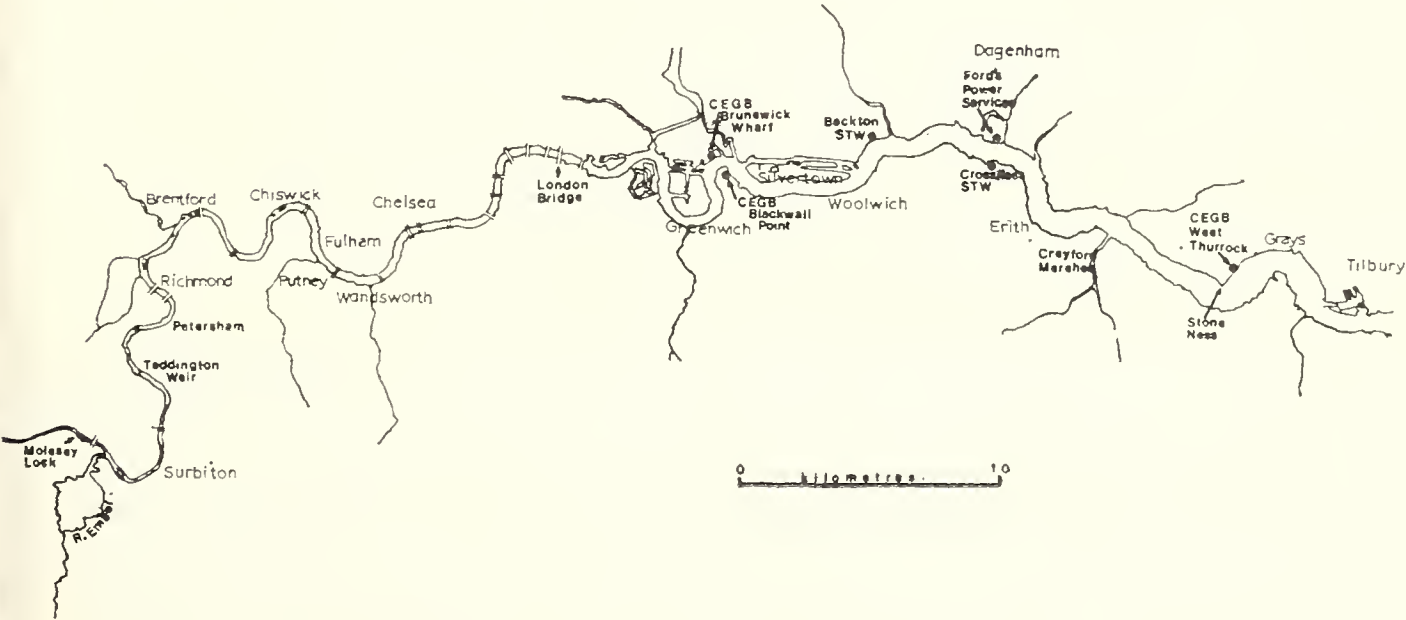
Dreissena polymorpha
Potamopyrgus jenkinsi

TUBIFICIDAE

Limnodrilus hoffmeisteri
Psammoryctides barbatus
Potamothrix hammoniensis
Tubifex tubifex

Clitellio arenarius

FIG. 1. The urban River Thames showing places mentioned in the text.



Marked changes in weather sequence over the last three weeks of September brought some relief to the exceptional drought situation, and further rain in October until the end of the year saw the end of the drought, and a return to a more normal situation with regard to salt-water penetration into the Thames estuary.

The half-tide salinity values found at London Bridge for 1975, which was also a dry year, and in 1976 are shown in Fig. 2. The concentration of chlorion reached a peak in 1976 at London Bridge of 4,800 mg/l, at Woolwich 9,650 mg/l, at Erith 10,750 mg/l, at Thurrock 14,200 mg/l and at Tilbury 14,500 mg/l. The sea water at the mouth of the estuary contains approximately 20,000 mg/l chlorion.

FIG. 2. River Thames chlorinity, London Bridge.

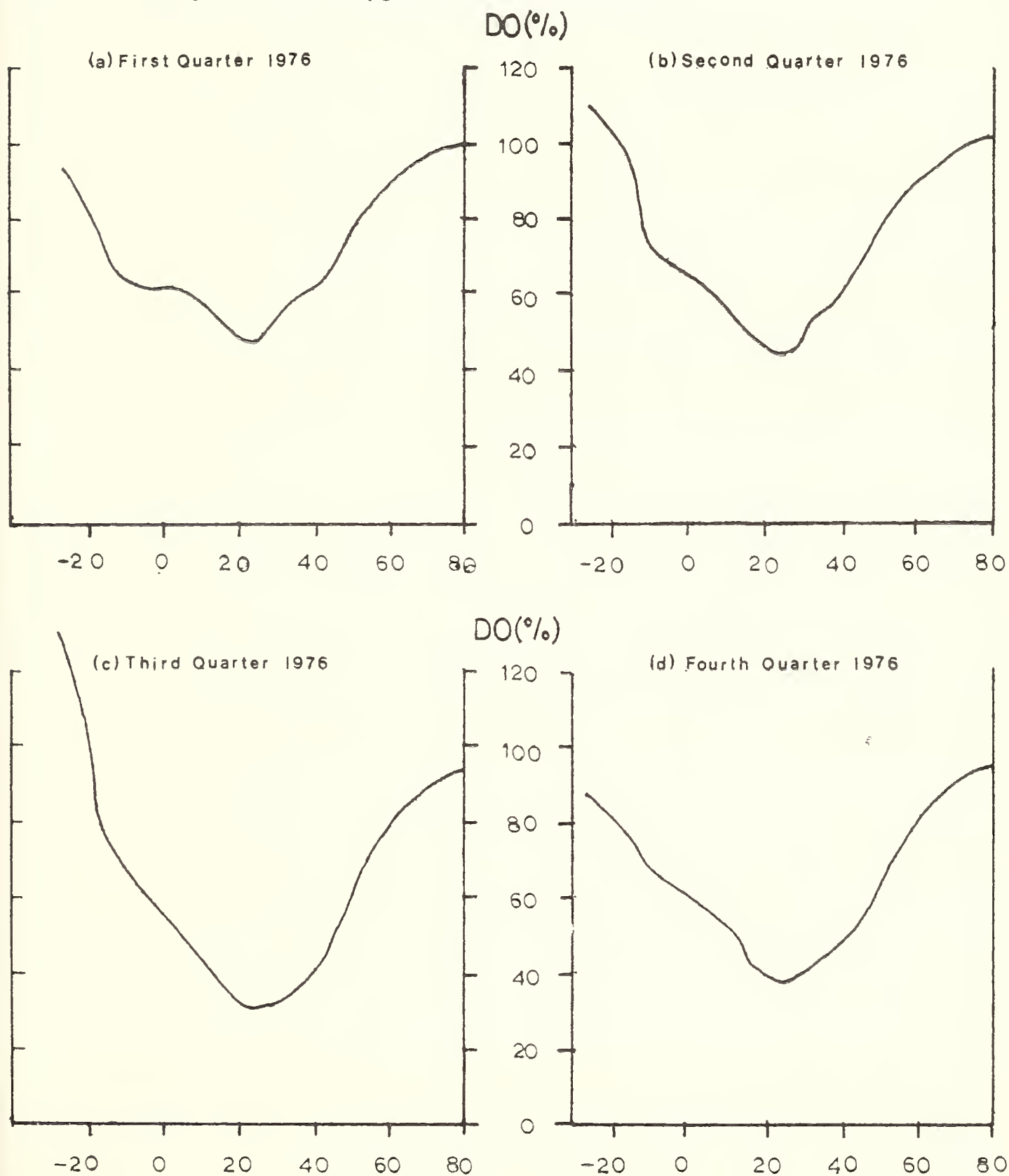


Dissolved Oxygen in 1976

A major source of dissolved oxygen in the Thames tide-way is that which enters with the freshwater going Teddington Weir. It has been shown (Water Pollution Research Laboratory 1964) that decreasing the flow at Teddington reduces the minimum oxygen level, displaces the minimum in a landward direction to about 15 km below London Bridge and increases the length of river in which low oxygen levels are found. Also, low flows greatly increase the retention time of sewage effluents in the urban Thames, which would have serious consequences for the fauna should those effluents be of poor quality.

With these facts in mind it is encouraging to report that the average minimum concentration of dissolved oxygen during the third quarter of 1976, expressed as a percentage of the air saturation value, remained high at 30 per cent off Crossness Sewage Works compared with 21 per cent near Erith in 1975. The oxygen content would be expected to be lowest during the third quarter because of the higher water temperature and lower solubility of oxygen at these higher temperatures. The levels of dissolved oxygen during the third quarter were the highest for any third quarter since 1882 when records for oxygen concentration were first kept. Average oxygen sag curves for each of the four quarters in 1976 are shown in Fig. 3.

FIG. 3. Average dissolved oxygen in the River Thames.



Ammonia Content in 1976

In general the average concentrations of ammonia were low throughout the tide-way, the maximum average value recorded being 0.2 mg/l.

The Penetration of Marine and Estuarine Species in 1976

Three groups perhaps best demonstrated the penetration of marine species into the urban Thames, these being the fishes, crustaceans, and worms. Each is considered separately below, with notes on other groups.

1. Fishes

In previous years freshwater species have dominated the catch in the London Bridge area, although a few euryhaline species, eels, smelts, and flounders have been taken, and a single sand goby was recorded at Fulham in 1969 (Wheeler 1969). In 1976, because screen sampling at power-stations above London Bridge was not possible, the upriver fish populations were investigated using a six foot (two metre) beam trawl, and despite the bias towards taking species living or feeding near the bottom, some interesting results were obtained. Sand gobies were numerous in Chelsea Reach (—8) during the summer and a few common gobies were found as far up as Chiswick (—19). Even more impressive was the presence of sprats in the Chelsea Reach in September 1976. The suspected presence in some numbers of certain euryhaline species was confirmed: smelts, eels, and flounders being taken regularly in the trawl. Young bass were frequently taken at and below London Bridge, their abundance in the urban river being indicated by the capture in September of 170 in only one and a half hours at Dagenham (+22·4).

Several thousand elvers were observed in the river both in 1975 and 1976 between London Bridge and Petersham (—27). On 16 July 1976, over 200 elvers were found in the effluent channel at Surbiton Sewage Works, these having successfully traversed the weir at Teddington (—32) and travelled almost 3 km in underground culvert from the main river to reach that position. Extremely large numbers were also observed in the Beckton effluent channel (+18). The main run of elvers, occurring as it did in June through London, coincided with the arrival of young flounders from the spawning sites in the outer estuary. Most of these young flounders were in the size range 10—25 mm total length, many of the smaller fish having only just fully metamorphosed.

Flounders were found throughout the urban estuary from Petersham (—27) to Tilbury (+40), although they displayed the tendency to collect at certain preferred sites in the tide-way. For example a 10 minute trawl in front of the old Beckton Gas Works at Barking (+16) in December 1976 yielded 301 first and second year flounders, while only 4 km further downriver on the Kent side less than 10 fishes were taken in similar trawling operations. It may be significant that the gas works shoreline is regularly visited by a group of up to 15 herons *Ardea cinerea*, cormorants *Phalacrocorax carbo* and several great crested grebes *Podiceps cristatus*, which can be seen taking fishes from the water there—a very encouraging sign when it is remembered that on average 800,000 cubic metres per day of treated sewage effluent is discharged to the river within 1 km of those feeding birds.

Smelts were found regularly throughout the tidal Thames in 1976, including some recently hatched fishes taken in June during trawls at Greenwich (+6·5) and London Bridge. It is apparent that the size of the smelt stock in the river is increasing, and confirms an earlier opinion (Wheeler 1969) that smelt have been running up the Thames since about 1968. On one occasion in December, 50 smelt were taken in two hours during sampling at West Thurrock Power-station (+35).

The sampling for estuarine organisms by their removal from circulatory water screens of power-stations situated on the river was carried out during 1976 using basically similar techniques to those described by other authors (Huddart & Arthur 1971a). The screens of power-stations at Brunswick Wharf (+11.4) and Blackwall Point (+12.9) showed the presence of a total of 25 marine and euryhaline fish species throughout the year. Wheeler (1969) in contrast recorded only six such species at those stations in the period 28 September 1967 to 31 October 1968, and showed that the region was then dominated by freshwater species which included perch, bream, pike, goldfish, roach, dace and ruffe. The only evidence of freshwater species near Blackwall Point in 1976 during the drought was the capture of single specimens of perch, bleak and bream, although later in the year freshwater fishes were again recorded. Species such as flounder, sand goby, eel and sprat were abundant at Blackwall Point (+12.9), and notable catches there during 1976 included 67 smelt, 38 poor cod, 31 great pipefish, 28 bass, 22 Raitt's sand eel, 8 sole, 5 anchovy, 4 sea snail, 4 mackerel, 3 lesser sand eel, 2 scad, 2 twaite shad, 1 allis shad, 1 tadpole fish and 1 five-bearded rockling.

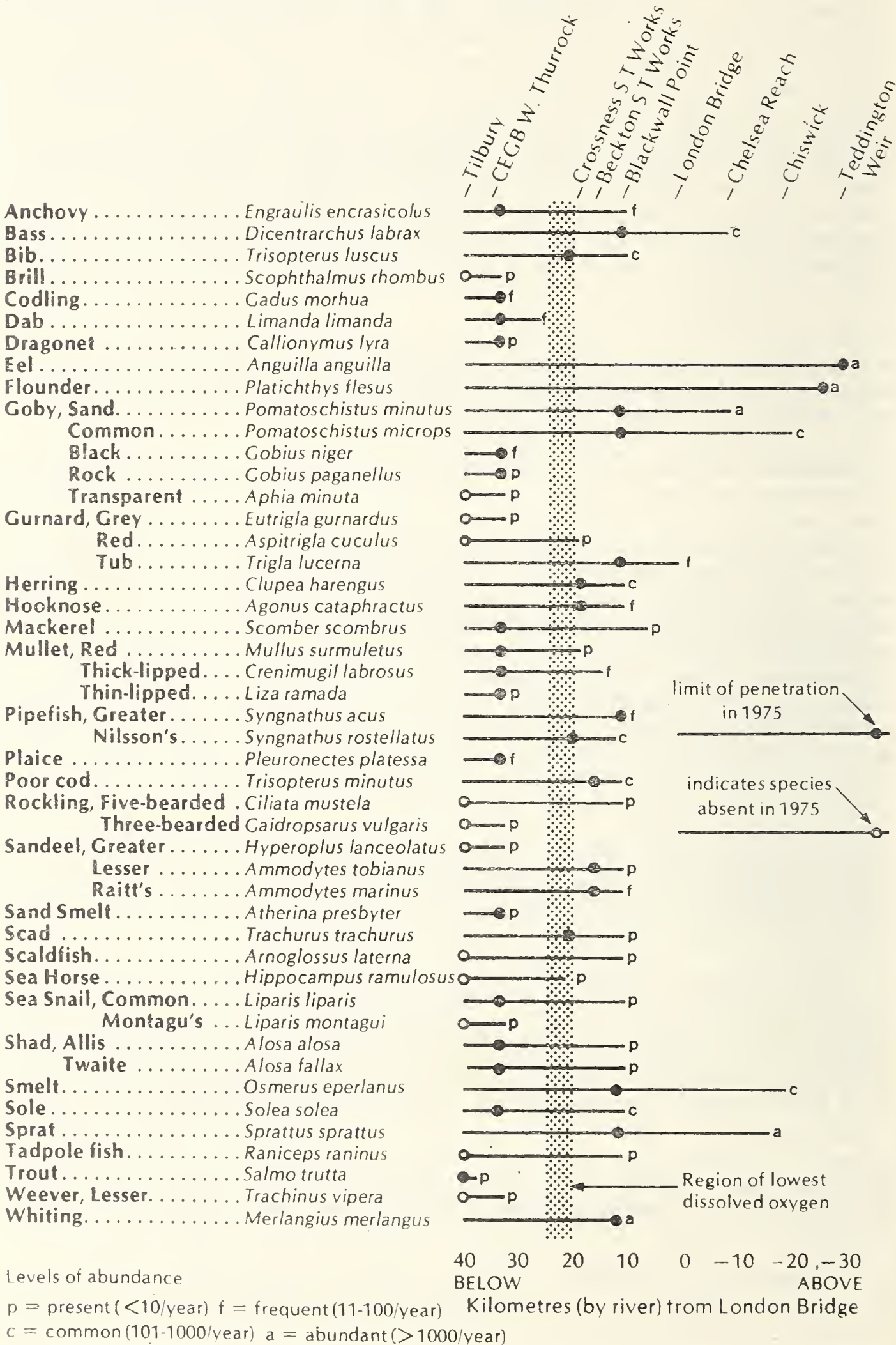
The presence of so many essentially marine species close to central London demonstrates that water salinity is now the major factor operating in the Thames tide-way that determines the degree of upstream penetration of marine fishes and that pollution is no longer the main barrier.

Significant samples were also obtained from the circulating water screens of an industrial power plant at Dagenham (+22.4). A greater number of individuals and variety of species of fishes than ever before were taken at that location. It can be seen from the map (Fig. 1) that the Dagenham site is in close proximity to the two major sewage works for London, and consequently must reflect to some degree the good quality of the effluent put out by those works. During the year 1976, 18 species of marine and euryhaline fish were recorded from the outfall area, along with two freshwater species, the roach and ten-spined stickleback, which probably reached the tide-way from a nearby freshwater tributary. The commonest occurring species at Dagenham were sprat, bass, common goby, sand goby, flounder, and eel, while other marine species included a sea-horse, Nilsson's pipefish, hooknose and sea snail. The penetration of marine and estuarine species into the urban Thames during 1976 is summarised in Fig. 4. It is quite probable that most species listed penetrated further than indicated in the diagram, since only very limited trawling was performed in the reaches above London Bridge. An indication of abundance is included for the listed species, based on the number of specimens of each listed fish that were taken through the year during routine investigation by the Thames Water Authority biologists within the boundaries of the urban Thames.

The dry weather and increased salinity did not have such a pronounced effect on the number of marine and euryhaline species taken in the region of West Thurrock Power-station (+35). The 41 such species recorded there during 1976 was only three greater than recorded in 1975, although significantly larger numbers of individuals were taken per unit volume of water used by the station. Not all the species recorded at Thurrock in 1975 were again taken in 1976, conger eel, dory, lamprey, black sea bream, lumpsucker and twaite shad being absent. However, nine species did occur in 1976 that were not found the previous year. These were three- and five-bearded rockling, lesser weever, transparent goby, greater sand eel, Montagu's sea snail, grey and red gurnard, and brill.

The part played by salinity increases at Thurrock in drawing marine species to the region is little understood, and the degree to which reaction currents are involved in the translocation of outer estuary fauna into the urban river is not

FIG. 4. Penetration and relative abundance of marine and estuarine fishes in the Thames in 1975 and 1976. The lengths of the horizontal lines indicate the distance upriver that each species travelled in 1976. Solid circles on the lines show the limits of upriver penetration in 1975, and open circles indicate species not found in the metropolitan area in 1975. Note that many species were able to traverse the zone of lowest oxygen levels (shaded) occurring just below London's major sewage outfalls.



clear. The water of the Thames estuary is normally well mixed, but a vertical salinity gradient is not always absent. Our results suggest that, at periods of very high river flows, a skate of freshwater occurs over a wedge of much more saline water near the bottom of the river. This vertical salinity gradient produces an enhanced upstream bottom drift effect (see Inglis & Allen 1957; Board 1973), capable of transporting marine animals into the urban zone. The area of river near West Thurrock (+35) is a good point at which to view the biological consequences of this effect, for the counter-clockwise eddies which occur just below Stone Ness (+34) at most states of the tide can trap marine animals in a pocket of higher salinity water on the downriver side of Stone Ness, especially on the late ebb tide. Marine species that have been taken in the vicinity of Thurrock only during periods of exceptionally high river flows, and which were found in a body of water with near-surface salinities far lower than, being marine organisms, they would normally tolerate, include the following: dory *Zeus faber*, trigger-fish *Balistes carolinensis*, northern rockling *Ciliata septentrionalis*, ballan wrasse *Labrus bergylta*, and lumpsucker *Cyclopterus lumpus*. It should be noted that these are all normally fairly sedentary species or are poor swimmers, and yet were taken in the autumn of 1974 during a period of near record river flows. (This was also the period when the first adult Thames salmon for over a century was taken at Thurrock!)

Irrespective of the mechanisms operating for the transport of marine fishes to the urban area at times of high rainfall, it is still encouraging to find codling, shads, sea snails, rock gobies, weevers, etc., in an area which Wheeler (1969) suggested contained no fish life, with the exception of eels, between 1920 and 1960.

2. Crustacea

The influx of marine fishes to the central urban area of the Thames was paralleled by the presence of several crustacean species, many of which were only previously found in the outer estuary. As in previous years at West Thurrock the common shrimp *Crangon crangon* was most prolific. However in 1976 the range of penetration of that organism was greatly extended, since trawling showed it to be present as far as Barnes (−17·5) upriver. Another fact worth mentioning is that through the year a high proportion of berried females were found, and this contrasts with the earlier finding (Huddart & Arthur 1971a) of only one egg-carrying female among 42,370 shrimps they collected from West Thurrock (+35) between 1968 and 1970. It has been suggested earlier (Huddart & Arthur 1971b) that shrimps probably were excluded from the river above West Thurrock by the presence of low oxygen tensions, and it is thus interesting to see how in less than a decade the levels of oxygen in the river have improved sufficiently for the penetration of shrimps to be greatly extended upriver. Also encouraging was the regular presence of five species of prawns in the urban river in 1976. By far the commonest was the ubiquitous *Palaemon longirostris*, but as this is tolerant of very low salinities perhaps it is not surprising that it was found at Chiswick (−19) during September 1976. Another species of prawn *Palaemonetes varians* known to be tolerant of freshwater was found in the London Bridge region, but occurred far less frequently than *Palaemon longirostris*. Previously in the Thames area *Palaemonetes varians* had been found by the author only in the drainage dykes of the Crayford Marshes, living in association with the freshwater mollusc *Lymnaea peregra*, dytiscid beetle larvae, coenagruid dragonfly larvae, and naid worms. *Palaemon serratus* was found at Brunswick Wharf (+11·4), and *P. elegans* penetrated to Dagenham (+22·4). Other prawns recorded were *P. adspersus* found in the summer and early autumn at West Thurrock (+35), several specimens of the pink shrimp *Pandalus montagui* at Tilbury (+40) and a few specimens of *Hippolyte varians*, also from Tilbury.

Within the river, gammarid species tended to occupy zones according to their salinity preferences. Their relative distributions have been found to be similar to those described for estuaries by Nicol (1968) except that in the Thames, *Gammarus duebeni* was generally found in salinities slightly higher than those which suited *G. zaddachi*. This may be due to the fact that the only place where *G. duebeni* had previously been found was in the drainage dykes at Crayford, and time may have been insufficient for it to progress upriver to the less saline regions, where it could then compete with, and possibly displace *G. zaddachi*. Table 1 has shown that the freshwater *G. pulex* could not tolerate the brackish conditions at London Bridge in 1976, but was displaced upriver to the Richmond (—24) area. *G. zaddachi*, although never present in large numbers, was found between Richmond and Fulham (—12.5) during the dry weather, compared with an area of from Wandsworth (—11) to Putney (—9) in 1975. *G. duebeni*, as indicated earlier, was found mainly in the Woolwich (+13) area, and possibly entered the Thames via outlets from drainage channels along the Erith to Crayford stretch of river.

Gammarus salinus was the most abundant species, and was recorded upriver at Battersea (—8) and throughout the brackish regions, until being replaced by *Gammarus locusta* in the outer estuary. *G. salinus* and the mud-burrowing amphipods *Corophium volutator* and *C. insidiosum* were major food items in the diet of young fishes in the area and may well also prove to be an important food source for the shoveler ducks *Anas clypeata* now wintering in small numbers in Barking Bay (+20) (Harrison & Grant 1976), since it is only during the last two years that the corophids have colonised that part of the river. During 1976, *C. volutator* was found in low concentrations just above Greenwich in Limehouse Reach (+5). *Talitrus saltator* was occasionally taken at Thurrock, but could regularly be found in the *Enteromorpha* growing on the river-walls across the river at Greenhithe (+34.5). Other amphipods, taken between West Thurrock (+35) and Tilbury (+40), were *Marinogammarus marinus*, *Melita palmata* and *Orchestia mediterranea*. Isopods from the Thames included *Ligia oceanica* collected as far up as Dagenham (+22.4), *Sphaeroma rugicauda*, which penetrated beyond London Bridge, and the less abundant *Jaera albifrons* and *Idotea chelipes*, mainly from Thurrock.

Five species of crab were taken during surveys in the urban area. By far the commonest was the shore crab *Carcinus maenas*, which in the summer of 1975 had reached Cross Ness (+21.5) but penetrated even further in 1976, specimens being taken at Blackwall Point (+12.9). During the late summer the swimming crab *Macropipus holsatus* was found in considerable numbers, and during a six-hour screen sampling survey at Thurrock (+35) in September, nearly 250 of these swimming crabs were taken. Several specimens were caught just above Crossness Sewage Works (+21) during trawling operations in that part of the river. Another swimming crab, *Macropipus puber* was found occasionally during the summer at Thurrock, but not above that point. Also specimens of the spider crab *Macropodia longirostris* were rarely taken at Thurrock, although these were numerous further down the river in Sea Reach (+55). Exciting finds in 1976 at West Thurrock were three specimens of the Chinese mitten crab *Eriocheir sinensis* (Ingle & Andrews 1976). The first, taken in February, was fragmented, but later in May and June live specimens were taken. Its occurrence in Britain was first reported in 1935 when a Thames specimen was taken at Chelsea (see *Proc. zool. Soc. Lond.* 1935: 948 (1935)), then in 1949 a second specimen was recorded, from Southfield Reservoir, near Castleford, Yorkshire (Cockerham 1949). These were the only records of the crab in Britain before 1976.

Mysidacea were recorded, and by far the commonest was *Neomysis integer* which was found throughout the region. Occasional specimens of *Schistomysis*

ornata, *Praunus flexuosus* and *Siriella armata* were found, although our sampling methods were not aimed at the collection of these animals, and their true abundance could not be measured.

3. Annelida

Table 1 shows also that freshwater oligochaetes were displaced from London Bridge during 1976. Even in the summer of 1975 the usual tubificid population was showing signs of being stressed. A survey carried out in 1971 had shown *Tubifex tubifex* and *Limnodrilus hoffmeisteri* to be present in a mixed population at a density of 300,000 per square metre (Birtwell 1972), yet this value had fallen to a maximum of only 4,000 per square metre by June 1975. The decline of the worms was probably related to salinity increases and to predation. The general cleaning up of the river may also have been a major factor in their removal, for Brinkhurst in Hart & Fuller (1974) states that, in general, the quantity and quality of organic matter reaching the sediment appears to play a more important role in determining which tubificid species will be found in any given locality, than do all of the commonly measured parameters of the water body or sediment. The decline of tubificid worms from London has been linked with the appreciable decline in the numbers of wildfowl, especially pochard *Aythya ferina* and tufted duck *A. fuligula*, in recent winters in the inner Thames (Harrison & Grant 1976).

The only oligochaete recorded from the London Bridge region during the drought was *Clitellio arenarius*, which had penetrated in low numbers from its position in previous years at Woolwich (+16). The brackish water species *Tubifex costatus*, which previously had reached peak densities around Erith (+27), did move towards London as the average upriver salinity increased, and became well established in the mud forming upstream of the construction works for the flood prevention barrier now being built at Silvertown (+14). There is little doubt that *T. costatus* could have survived at London Bridge while the salinity remained above 2000 mg/l chlorion.

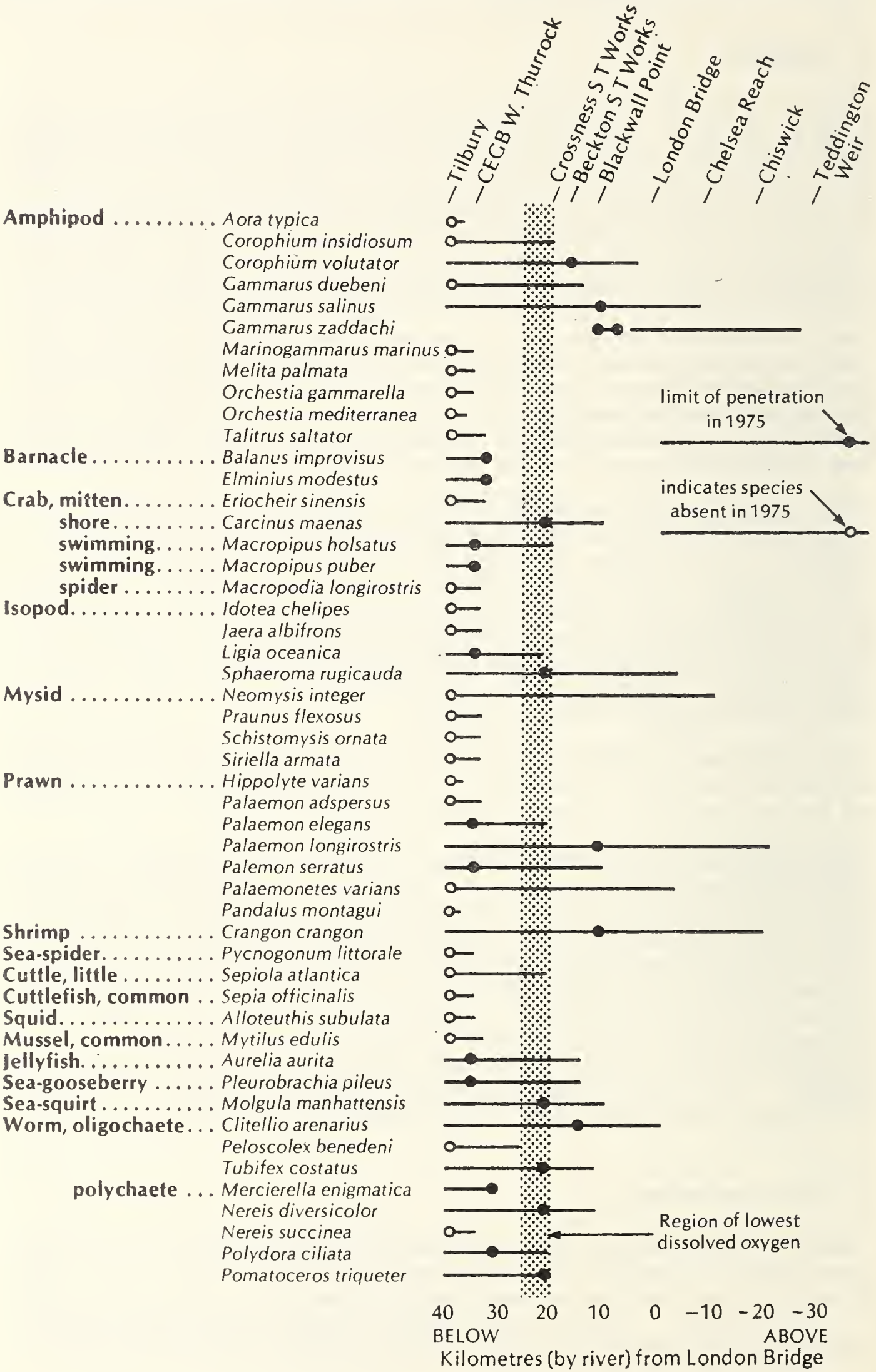
The more marine oligochaete, *Peloscolex benedeni*, which normally occurred outside the urban area, was recorded in 1976 as far as Woolwich (+16) upriver, and the mud at Erith (+27) contained appreciable numbers of this worm.

Polychaete worms were little affected, it seems, by the drought. *Polydora ciliata* was taken at Cross Ness (+21), which was only slightly further upriver than in 1975, while the ragworm *Nereis diversicolor* extended its penetration by about 10 km from Cross Ness to above the barrier site at Silvertown (+14). Very occasionally, specimens were taken in the Blackwall Point (+13) region and two were taken at Tower Bridge (+1) in October. The similar *Nereis succinea*, which before 1976 was not found in the urban river, being a more marine species, was taken on several occasions at West Thurrock (+35). As in 1975, both *Pomatoceros triqueter* and *Mercierella enigmatica* were found regularly, but since our sampling methods tended to overlook these species, very little can be said about their increased penetration in 1976.

4. Other Organisms

In 1976 cephalopods were recorded from the urban Thames for the first time, having been encouraged to enter the region by the increased salinity of the water. Three fully grown common cuttlefish *Sepia officinalis* were found in September at West Thurrock. The little cuttle *Sepiola atlantica* also occurred regularly there during September and October, as did the squid *Alloteuthis subulata*.

FIG. 5. Penetration of marine and estuarine macro-invertebrates in the Thames in 1975 and 1976. The lengths of horizontal lines indicate the distances that species travelled upriver in 1976. Solid circles on the lines show the limit of upriver penetration in 1975, and open circles indicate that a species was not found in the metropolitan area in 1975.



Large numbers of the common jellyfish *Aurelia aurita* were found in the summer months above Barking (+ 17.5). They were not found above Thurrock in 1975, although jellyfish were seen off West India Dock in the summer of 1972 by A. C. Wheeler (personal communication). Many hundreds were taken on the screens at the Dagenham Power-station (+ 22.4). The distribution of *Aurelia* was very similar to that of another planktonic coelenterate, *Pleurobrachia pileus*, which was taken in our trawls from June to September. The ascidian *Molgula manhattensis* was very abundant at certain locations in the river in 1976, when they were found at Blackwall Point (+ 12.9). Before 1976 this species was known only below Cross Ness (+ 21).

The marine sea-spider *Pycnogonum littorale* was occasionally found at Tilbury (+ 40), although it was generally associated with strands of dead *Sertularia* sp., a hydroid commonly found growing in Sea Reach (+ 55). The *Sertularia* probably entered the region by the landward bed drift effect described earlier, this also being the only reasonable explanation for its presence in trawls above London Bridge.

Figure 5 shows diagrammatically the penetration upriver of marine and estuarine macro-invertebrates in 1976, and compares the recorded position for each species in 1975. It can be seen that many species approached the river zone (shaded on Fig. 5) in which the trough of the oxygen sag curve occurred; indeed, very large numbers of invertebrates thrived within that zone.

Conclusions

The exceptional dry summer of 1976 demonstrated conclusively that a large number and range of estuarine and marine species could now thrive in what was until a little over a decade ago, a very polluted region of the River Thames.

A dead salmon *Salmo salar* was taken from the non-tidal Thames at the end of 1976, at the mouth of the River Ember, which is just below the first weir likely to be impassable to migrating adult salmonids. If that fish had genuinely lived for a period in the Thames, and the author has no reason to think otherwise, then it is the first positive record of an adult salmon above London for over 140 years, and reinforces the earlier statements that pollution in the Thames no longer forms a barrier to the movement of animals.

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The Serpentine Fish and their Parasites

by R. L. G. LEE*

Abstract

The Serpentine lake in Hyde Park and Kensington Gardens in central London supports populations of 12 fish species. The fish fauna of the lake is a healthy, self-perpetuating one. Roach *Rutilus rutilus* and perch *Perca fluviatilis* are the most abundant species, and these together with the tench *Tinca tinca* grow to a large size. The fish population is infected with 14 species of parasites. Cestodes, *Ligula intestinalis* and *Proteocephalus percae*, and the nematode *Camallanus lacustris* were common in the viscera; the digenean *Diplostomum spathaceum* infected the eyes of all fish species. Birds, planktonic crustaceans and molluscs were important components in the parasite life-cycles. The nature of the fish fauna and its parasite population is discussed in relation to the history of the ecosystem and the character of the extant flora and fauna. The significance of the absence of pike *Esox lucius* is mentioned.

Introduction

In 1970 a programme of research was started in order to study the population dynamics of a freshwater fish and its associated helminth fauna in relation to the seasonal environmental variables. Permission was obtained from the Bailiff of the Royal Parks to collect fish samples from the Serpentine, a semi-artificial impoundment in Hyde Park and Kensington Gardens in central London. The Serpentine must be one of the most public bodies of water in the world: every year thousands of people walk around it, drive over it, boat on it and even swim in it. This lake was suitable for various reasons: it was easy to fish there, it was close to the laboratory and it was known to contain a healthy fish population. Originally it had been intended to study and compare the perch *Perca fluviatilis* and the ruffe (or pope) *Gymnocephalus cernua*. Pressure of time precluded the study of the latter being continued, but the ruffe and several other fish species were periodically examined from 1970 to 1973. Between December 1970 and January 1972 an intensive sampling programme was conducted each month in order to obtain random samples of perch and, for a separate research programme at Queen Mary College, University of London, samples of ligulated roach.

Fish ecology is an immense subject with an equally immense body of literature, but the study of fish parasite ecology has received much less attention. The field of fish parasitology has been reviewed by Chubb (1970) and Kennedy (1970). Kennedy (1974) has given a checklist of British and Irish freshwater fish parasites.

The purpose of this paper is to present neither a technical report on the ecology of Serpentine fish nor a complex treatise on their parasites since both these topics are being dealt with elsewhere. Rather this paper aims to present some data and observations on the Serpentine fish fauna and its parasites and, where possible, to draw some conclusions about the nature of the water.

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Description of the Habitat

History and General Features

The Serpentine is an artificial lake within the borders of two Royal Parks, Hyde Park and Kensington Gardens, in the City of Westminster. The parks and lake are used extensively for recreational purposes. The Ordnance Survey grid reference of the Serpentine is TQ 271801; it is situated at $0^{\circ} 10' \text{ W.}$ longitude, $51^{\circ} 30' \text{ N.}$ latitude. The water surface is 11 metres (35 feet) above ordnance mean datum. The lake has a capacity of approximately 360 million litres (80 million gallons) and covers an area of 16.4 hectares (40.5 acres): of this area about 13 hectares covers the Serpentine itself and 4 hectares cover the extension north of the road bridge which is more correctly called the Long Water. However the whole body of water is continuous and is normally referred to as the Serpentine. There is one small island, covering less than 0.1 hectares in the lower basin.

The original Serpentine, in the shape of a canal, was constructed between 1730 and 1733 at the instigation of Queen Caroline, wife of George II. This was done by damming the Westbourne Brook, sometimes called the Ranelagh Brook or Bays Water, at the lower end of a series of ponds and marshes (Barton 1962). In 1820 it was extended by Nash to give it its present appearance. In 1835 the brook supplying the lake had become so badly polluted that it was dammed and the flow partially diverted into the Ranelagh sewer in Bayswater Road; this diversion of the flow was made absolute in 1860. The lake was drained in 1849 and the bottom sealed with clay and concrete (Barton 1962). The course of the original Westbourne, supplying the area with water from springs on Hampstead Heath, has been lost, but some of this water may still enter the lake by seepage. The main supply of water to the Serpentine, other than surface run-off from the parks, is by pumping water up from the well on Duck Island, St James's Park, which was dug in 1865 (Pentelow 1965); this water also supplies the Buckingham Palace Lake, the Queen Victoria Memorial and a reservoir in the middle of Hyde Park. The outflow from the Serpentine is from the south-east corner into the Ranelagh sewer. The course of the original brook was under the Knight's Bridge (= Knightsbridge) and on through Sloane Square to the Thames (Barton 1962). After leaving Hyde Park the Ranelagh sewer approximately follows this direction and may be seen where it passes through Sloane Square Underground Station in a metal conduit. If necessary, valves can be adjusted to carry water to the lakes in the grounds of Buckingham Palace and St James's Park. Thus under certain circumstances there is a continual circulation between the lakes in Hyde Park, the grounds of Buckingham Palace and St James's Park.

Physical and Chemical Features

The Serpentine lies in the middle of the London basin which is a downfold of chalk running from the North Downs to the Chiltern hills. The basin is floored with impervious London Clay and occasional sand deposits. The lake is 1.6 km (one mile) long and gradually widens from 46 m (50 yd) at the northern end to 183 m (200 yd) at the south-eastern end. The depth of water varies from as shallow as 0.5 m (20 in) near the fountains to 8 m (26 ft) in the middle of the lower basin. There is a bathing area along the southern shore covering 334 x 37 m; in this area the water is treated with an average of 20 kg (45 lb) of chlorine every hour over a 12 hour period each day during the summer. The lido water is not separated from the rest of the lake but in most of the Serpentine the chlorine concentration is low. During 1971 the height of the water did not vary by more than a few centimetres. Water entered the lake at a temperature of $6^{\circ} - 11^{\circ} \text{C}$ during 1971. Very low water temperatures were

rare and the surface was frozen for only a few days in February 1971. In mid-summer 1971, the temperature of the surface water reached 22°C. From June to September 1971 there was a rather indistinct metalimnion at 3–4 m. The hypolimnion maintained a temperature of 12°–15°C during this period. Such a relatively high temperature may be explained by the low outflow, about 2300 litres/hour (500 gallons/hour), and is at surface level.

The Serpentine is a eutrophic lake. The oxygenated water from the fountains helps to maintain aerobic conditions throughout the year. The bottom consists of gyttja—a fine brownish sediment, characteristic of the permanently oxygenated conditions (Ruttner 1963). A further indication of the oxygenated conditions was the presence of oxidised iron material dredged up in the nets throughout 1971. The water pH varied from 6·8 to 7·4 during the year.

Despite being protected from the wind the water is very turbid with much inorganic and organic material in suspension, resulting from the clay and sedimentary bottom and the abundance of plankton. Secchi disc readings were occasionally taken during 1971 and varied from under one metre during a May algal bloom, to nearly two metres in mid-winter. In a large and deep body of water such turbidity can cause a decrease in productivity by decreasing light penetration (Macan & Worthington 1950). However, the Serpentine is small and shallow so the decline in productivity is probably negligible. Despite the high organic content of the water there is little evidence of summer stagnation. It is probable that the pleasure boats on the lake, which stir up much of the turbidity, are also beneficial in keeping the water circulating.

The Flora and Fauna

The flora and fauna in the Serpentine are diverse and, at times, abundant. There are no clearly defined littoral or benthic zones. The lake supports a balanced aquatic community and has been self maintaining and self regulating for many years. The only direct interference by man on the balance of the ecosystem is the occasional culling of the waterfowl. An extensive survey of the biotic features of the lake is desirable but beyond the scope of this study. The following general observations were made.

Zooplankton were prolific and numerous in all months during 1971. The major groups present were Cladocera, especially *Daphnia* spp. and *Bosmina longirostris*, and calanoid and cyclopoid Copepoda, especially *Diaptomus* spp. and *Cyclops* spp., Isopoda, *Asellus* sp., and Ostracoda were sometimes found. Amphipoda, *Gammarus* spp., were not common. A wide variety of insect larvae, pupae, nymphs and adults were found at various times during the year. Diptera, and in particular, chironomids, were plentiful. Molluscs were not abundant but the following were found: *Anodonta cygnaea* the swan mussel, *Planorbis* spp., *Lymnaea* spp. and *Sphaerium corneum*. *Tubifex* sp., a chaetopod Oligochaete, were found in the bottom sediments on rare occasions. No leeches were found.

Except for the phytoplankton, the flora of the lake was not abundant. This was perhaps due to the grazing by the numerous ducks. The rooted aquatic plants were mostly *Elodea* spp., and *Potamogeton* sp. was found around the shoreline.

Besides the fish fauna, the only vertebrates seen were birds and frogs. It is probable that toads and even water-voles are present. The lake supports a prolific and diverse population of water birds, both residents and migratory species. The latter would appear to provide one of the few allochthonous elements in the lake. Some of the commoner birds were mute swans *Cygnus olor* (L.), canada geese *Branta canadensis* (L.), mallards *Anas platyrhynchos* (L.), tufted ducks *Aythya fuligula* (L.), coots *Fulica atra* (L.), moorhens *Gallinula chloropus* (L.) and gulls *Larus* spp.

Materials and Methods

Fish samples were caught each month using seine nets and trap nets. Gill nets were tried but proved unsuitable since they caught a few perch (the main object of the sampling) but large numbers of other species which were dead when the nets were raised. An ulstron twine seine net, weighted to sink, was used: it was 69 m (75 yd) long, 2.4 m (8 ft) deep and had a stretched mesh size of 2.5 cm. A seine with a smaller mesh was tried but proved unsuccessful in catching fish fry. Unbaited fish traps, as described by Allan *et al.* (1958), were also used; they had a mesh size of 2 cm. Fish traps with a finer mesh designed to catch fry were unsuccessful.

Fish were returned to the laboratory live, and there they were either killed by pithing then deep-frozen at -18°C or kept alive in freshwater tanks supplied with oxygenated water from a rising main at $10^{\circ} - 14^{\circ}\text{C}$. It was found preferable to examine freshly killed fish for parasites but fish were never kept alive for more than one day before autopsy lest they void gut parasites or stomach contents. Weather data were obtained from the Meteorological Office, Bracknell, and the water temperature of the Serpentine was continuously recorded at a depth of one metre by a Cambridge Single Thermograph.

The abundance of the parasites is expressed by two parameters: a) incidence of infection: this is the percentage of fish in the population (or sample) infected, and b) intensity of infection: this is the mean number of parasites per fish in the whole population; it is not the mean number of parasites per infected fish.

Results

Sampling of the Serpentine fish fauna continued from January 1970 to July 1973. During most of this period sampling occurred only occasionally and it was only from December 1970 to January 1972 that intensive fishing was carried out each month and continued until at least thirty perch had been obtained. The Serpentine fish fauna is diverse and abundant (Table 1). The precise history of the piscine fauna is uncertain but it has not been significantly interfered with for some years and has certainly been stable, self-perpetuating and self-regulating for several decades.

TABLE 1. Species of fish and their estimated abundance in the Serpentine, 1971.

Species	Common name	Estimated population
Anguillidae		
<i>Anguilla anguilla</i> (L. 1758)	eel	?
Cyprinidae		
<i>Carassius auratus</i> (L. 1758)	goldfish	?
<i>Carassius carassius</i> (L. 1758)	crucian carp	?
<i>Cyprinus carpio</i> L. 1758	carp	2/4,000
<i>Gobio gobio</i> (L. 1758)	gudgeon	4,000
<i>Phoxinus phoxinus</i> (L. 1758)	minnow	?
<i>Rutilus rutilus</i> (L. 1758)	roach	100,000
<i>Scardinius erythrophthalmus</i> (L. 1758)	rudd	?
<i>Tinca tinca</i> (L. 1758)	tench	2/4,000
Percidae		
<i>Gymnocephalus cernua</i> (L. 1758)	ruffe, pope	6,000
<i>Perca fluviatilis</i> (L. 1758)	perch	30,000
Gasterosteidae		
<i>Gasterosteus aculeatus</i> L. 1758	three-spined stickleback	?

On the basis of catch per unit effort data crude estimates were made of the total populations of each species (Table 1). These figures should be viewed with reservation because fishing operations were particularly directed towards catching perch and ligulated roach. The roach *Rutilus rutilus* is undoubtedly the dominant species in the lake followed in abundance by the perch *Perca fluviatilis*. It seems reasonable that there are 100,000 to 200,000 fish of all species in the Serpentine. The fish fauna is not evenly distributed throughout the whole lake; far more fish of all species and all sizes were caught in the Long Water by both seine and traps. Fishing in the Serpentine itself was much less successful except for fish traps set around the island in winter and spring. This location is at the edge of the deepest water in the lake and appears to be the spawning place for roach, perch and tench *Tinca tinca*. Sadly, the area where there appear to be fewest fish is along the southern shore where, during the open season, angling is permitted. This is perhaps caused by the drift of chlorinated water from the lido. There are two reasons for the larger number of fish found in the Long Water. Firstly, the fountains provide a constant supply of oxygen saturated water. Secondly, the banks of this part of the lake are "natural" and overhung with bushes and trees whereas the banks of the Serpentine itself are asphalt and concrete. Thus the Long Water may be expected to contain more natural fish food.

The ecological and parasitological work in the Serpentine was concentrated on perch. Some of the other fish present were periodically examined for parasites. The host/parasite list has been partly reported by Kennedy (1974). In all, 14 species of parasites were recovered (Table 2) and these represent a wide range of eight taxonomic groups:

Protozoa	1 species
Monogenea	2 species
Digenea	3 species
Cestoda	3 species
Nematoda	2 species
Acanthocephala	1 species
Mollusca	1 species
Crustacea	1 species

The only parasites to be found in all fish examined—carp, roach, gudgeon, perch, ruffe and eel—were glochidia from *Anodonta cygnaea* the swan mussel, and the eye fluke *Diplostomum spathaceum*. Glochidia were not common throughout the year but were most prevalent in spring and early summer when the incidence of infection reached 60 per cent of all perch in March and 71 per cent of all ruffe in May. The intensity of infection was not high, being 25.5/fish for perch (March) and 11.7/fish for ruffe (May). At other times of the year and for all other fish species the level of infection was much less.

Anguilla anguilla

Eels were once put into the lake in St James's Park and before the building of the Hyde Park Corner underpass would have been able to reach the Serpentine via Buckingham Palace Lake; in 1972 St James's Park Lake was drained and about a dozen eels found (Wheeler pers. comm.). Five eels were caught in the Serpentine fish traps. All were about the same size, and one caught on 23 June 1971 was examined in detail after killing with MS222. This specimen, a female, weighed 1625 g (3.6 lb), was 87.5 cm in length and had a maximum girth of 28.3 cm (11.1 in). The otoliths were examined and the fish assessed as being

TABLE 2. Parasites found in roach, gudgeon, ruffe and perch in the Serpentine, 1971.

Roach <i>Rutilus rutilus</i>		Site of infection
Monogenea		
	<i>Dactylogyrus crucifer</i> (Wagener 1857)	gills
Digenea		
	<i>Diplostomum spathaceum</i> (Rudolphi 1819)*	lens of eye
Cestoda		
	<i>Ligula intestinalis</i> (L. 1758)*	body cavity
Crustacea		
	<i>Argulus foliaceus</i> (L. 1758)	gills
Gudgeon <i>Gobio gobio</i>		
Digenea		
	<i>Diplostomum spathaceum</i> (Rudolphi 1819)*	lens of eye
	<i>Tylodelphys clavata</i> (Nordmann 1832)*	vitreous humor of eye
Cestoda		
	<i>Ligula intestinalis</i> (L. 1758)*	body cavity
Nematoda		
	<i>Camallanus lacustris</i> (Zoega 1776)	gut
Ruffe <i>Gymnocephalus cernua</i>		
Monogenea		
	<i>Dactylogyrus amphibothrium</i> (Wagener 1857)	gills
Digenea		
	<i>Diplostomum spathaceum</i> (Rudolphi 1819)*	lens of eye
Cestoda		
	<i>Proteocephalus percae</i> (Muller 1780)	gut
Nematoda		
	<i>Camallanus lacustris</i> (Zoega 1776)	gut
	<i>Eustrongylides</i> (? <i>excisus</i>) (Jagerski 1909)*	wall of gut within the body cavity
Acanthocephala		
	<i>Acanthocephalus lucii</i> (Muller 1776)	gut
Perch <i>Perca fluviatilis</i>		
Protozoa		
	<i>Myxozoma mulleri</i> (Bond 1939)	gills
Digenea		
	<i>Diplostomum spathaceum</i> (Rudolphi 1819)*	lens of eye
	<i>Tylodelphys clavata</i> (Nordmann 1832)	vitreous humor of eye
	<i>Rhipidocotyle illense</i> (Ziegler 1883)	rectum
Cestoda		
	<i>Proteocephalus percae</i> (Muller 1780)	gut
	<i>Triaenophorus nodulosus</i> (Muller 1776)*	liver
Nematoda		
	<i>Camallanus lacustris</i> (Zoega 1776)	gut
	<i>Eustrongylides</i> (? <i>excisus</i>) (Jagerski 1909)*	wall of gut within the body cavity
Acanthocephala		
	<i>Acanthocephalus lucii</i> (Muller 1776)	gut
Crustacea		
	<i>Argulus foliaceus</i> (L. 1758)	epidermis

* Larval Stage

15 years old. The stomach was empty except for a few fish scales. The gills and liver were free of parasites but the left eye lens contained three *Diplostomum spathaceum* metacercaria. The intestine contained 18 *Camallanus lacustris* which, in contrast to the distribution of this nematode in the perch, were grouped in the mid-region of the intestine.

Carassius auratus

No goldfish were actually caught in the Serpentine but specimens were often seen in the shallow waters at the north end of the Long Water or close to the surface of the water under the bridge. That none were caught suggests that the numbers are small or that the species has recently been introduced to the lake, probably by the release of domestic pets. The goldfish is a hardy species and is now often found in a feral state in England (Maitland 1972), so it may be expected to thrive in the Serpentine.

Carassius carassius

Crucian carp were taken by seine netting; none were caught in trap nets. They were taken so irregularly that it is not possible to estimate the population, which presumably is small. Specimens weighing up to 0.45 kg (1 lb) were common. It was noted that the gills were heavily infested with glochidia especially in early spring.

Cyprinus carpio

Common carp were taken by seine netting and fish taken weighed up to 0.45 kg. While the seine was being drawn into the bank, carp were often seen jumping out over the float-line to freedom; the "ones that got away", naturally, were enormous (!), but several fish estimated as reaching 1.4 kg (3 lb) were seen. Like the crucian carp, the common carp were heavily infested with glochidia on the gills during spring. The only other parasite noted on the common carp were metacercaria of the digenean *Diplostomum spathaceum* in the lenses of the eyes.

Gobio gobio

Many specimens of gudgeon from 10-12 cm in length were caught by seining. A number of gudgeon (43) were examined for parasites at various times. Apart from glochidia, which infested the gills of 31 fish (72%), the following helminths were recorded (Table 2):

Digenea: Metacercaria of *Diplostomum spathaceum* infected the lenses of the eyes of 91% of the fish examined: the mean intensity of infection was very high, being 63.1 parasites/fish with severe infections in excess of 200. The parasite was most prevalent in mid-winter. *Tylodelphys clavata* was identified from one specimen.

Cestoda: Plerocercoids of *Ligula intestinalis* were found in the body cavity of eight specimens (19%). However, in comparison with Serpentine roach (see below) the infections were light, averaging only 1.43 worms/fish with a maximum infection of four worms. Also, again in contrast with roach, ligulated gudgeon were caught in all weathers.

Nematoda: the anterior portion of the intestine of gudgeon were sometimes infected with *Camallanus lacustris*. One third of the gudgeon examined (14 fish) were infected usually with one or two worms, the maximum infection was four and the mean number of worms per fish was 1.67.

Phoxinus phoxinus

A few minnows were caught in the Serpentine, usually by their gills in the seine net. However, judging from the numbers caught by small boys in jam jars, the number of minnows in the water is probably very high.

Rutilus rutilus

Roach were by far the commonest fish caught in the Serpentine. A seine net haul might have upwards of a thousand. Despite such abundance, the species was sometimes surprisingly rare and its catchability was related to weather conditions. On dull, cloudy days large numbers were caught whereas on clear, sunny days the species was apparently much rarer. This phenomenon was especially noticeable with ligulated roach. Many of the roach caught, particularly in the fish traps, were fine specimens. The heaviest one weighed 0.434 kg, just under one pound. In all 86 roach were examined for parasites.

Monogenea: in the Serpentine 67 roach (80%) were infested with *Dactylogyrus crucifer* on their gills. The mean infection was 4.32 parasites/fish and the maximum infection (per fish) was 9. Each gill arch was not equally infested: of all parasites found 40.5% were found on the second arch with 25.3%, 24.6% and 9.6% on the first, third and fourth arches respectively.

Digenea: roach were very heavily infected in the lens of the eye with metacercaria of *Diplostomum spathaceum*. In late autumn the incidence of infection reached 100% but was lower during the summer months. The overall incidence of infection was 60% (52 fish). The intensity of infection was as high as 28.3 worms/fish in late autumn. The maximum number of worms recorded in one roach was 153.

Cestoda: plerocercoids of *Ligula intestinalis* were found in 14 (21%) of the roach examined. As fishing operations were partly directed towards obtaining ligulated roach this figure may be artificially high. The mean intensity of infection was 3.4 worms/fish and a maximum of 14 plerocercoids were recovered from one roach. The worm is extremely large and causes appreciable displacement of the organs of the body cavity. It was found that, in one roach, the nine plerocercoids accounted for 35% of the total fish weight. Ligulated roach were most readily caught in seine nets south of the road bridge on dull, cloudy days. Specimens were very rarely taken in the fish traps north of the road bridge.

Crustacea: one specimen of *Argulus foliaceus* was recovered from the third gill arch of a single roach.

Scardinius erythrophthalmus

In January 1970, a fish was caught in a seine net and identified as a rudd before being returned to the water. No other fish identified as rudd were caught and confirmation that there are rudd in the Serpentine is needed.

Tinca tinca

Tench were commonly caught in late spring and early summer in fish traps set around the island. These fish were large specimens in good condition and were presumably congregating to spawn. At other times during the year, smaller tench were taken in the fish traps and by seining in the Long Water, north of the road bridge. Tench grow to a large size in the Serpentine and fish

over two pounds were common. The largest specimen actually weighed was 1.21 kg (nearly 2.5 lb). Since this is the largest size of tench which could readily enter the fish traps, it may be assumed that even larger fish also inhabit the lake. It was frequently noticed that traps containing tench very rarely had any other species in them, whereas perch, roach, ruffe, carp and gudgeon were commonly caught together in the same trap. This suggests that the tench shoal and are, in some way, repellent to other fish species.

Gasterosteus aculeatus

Specimens of three-spined sticklebacks were sometimes caught by their gills in the meshes of the seine. However, the species was often observed swimming in the shallow water or in small boys' jam jars. Like the minnow, sticklebacks are probably abundant in the Serpentine.

Gymnocephalus cernua

Ruffe were common in the Serpentine and were caught, usually by seining, at regular intervals. At one time it had been intended to compare the parasite fauna of ruffe and perch, but work on the former was discontinued when it was found that time did not permit thorough sampling of both species. However, a reasonable sample of 55 ruffe were examined at various times during the year.

Monogenea: *Dactylogyrus amphibothrium* was found on the gills of 39 ruffe (71% of the sample). The mean intensity of infestation was 7.3 worms/fish with a maximum of 28 worms/fish. The second and third gills were equally and most heavily infested: the first and fourth gills were only lightly infested.

Digenea: all ruffe were infected with metacercaria of *Diplostomum spathaceum* with a mean intensity of infection of 14.3 worms/fish and a maximum of 83 worms/fish. Ruffe were not examined during the summer months and thus it is not known whether or not *D. spathaceum* is absent from the fish at this time, as it is from the perch.

Nematoda: the encysted larvae of *Eustrongylides* sp. were occasionally found within the body cavity attached to the intestine. Identification of this genus to species from the larvae alone is difficult and the specific designation of *E. excisus* is tentative. Nine ruffe (16%) were infected, usually with only one cyst (0.29 worms/fish) but one fish had as many as five cysts. *Camallanus lacustris* infected 22 (40%) of the ruffe: the mean intensity of the infection was 8.3 worms/fish and a maximum of 38 worms were recovered from one specimen. In contrast to the gudgeon and perch, this parasite was found in the distal portion of the intestine.

Acanthocephala: ten ruffe (18%) had specimens of *Acanthocephalus lucii* in the intestine. Usually only one worm was present but as many as five were recovered from a single fish. The mean intensity of infection was 0.4 worms per fish. This parasite was always recovered from the third quarter of the intestine. Such a consistent site of infection indicates a finely developed site selection ability. Antagonism and mutual exclusion between acanthocephalans and other helminth parasites of fish has been reported (Dogiel *et al.* 1961). However there were insufficient data for this to be verified in the ruffe.

Perca fluviatilis

Between December 1970 and January 1972, 611 perch were caught. All these fish were weighed, measured, aged (by their opercular bones) and autopsied for parasites. At least six fish in each age group up to five years old were caught every month and fishing operations continued until this quota was filled.

Freshly hatched fry were first caught in August. Fish older than five years old were less common but fish up to 11 years were caught. Fish between the lengths of 6 and 30 cm were readily caught by a combination of seine nets and trap nets. The former caught prolific numbers of smaller perch and the latter readily caught larger fish. Small perch, smaller than 6 cm, were, like minnows and sticklebacks, hard to catch; most were caught by their gills in the seine net. The whole population was 41.5% male but this value varied between 61.5% for fry to a low of 21.6% for four year old fish. Growth rate of Serpentine perch is rapid and is characterised by a surge or slight increase in growth rate at about four years old. This surge appears to be correlated with the change from insectivorous diet of young fish to the predominantly piscivorous diet of older fish. No significant differences were found between the growth rates of males and females. After one year Serpentine perch average 7.2 cm (2.9 in) in length, at five years they are 23.0 cm (9.0 in) and after eight years 35.1 cm (13.8 in). The largest specimens caught were not the oldest but were three nine year old perch taken in the traps in August. The largest of these was 41.0 cm (16.2 in) fork length and weighed 1.320 kg (2.9 lb). Like the tench, these large perch were the biggest size which could force their way into the fish traps, so it may be assumed that even larger perch are found in the Serpentine. Specimens of over nine pounds have been reported from the lake but this has not been authenticated (Wells 1941) and the weight record for British rod caught perch is only 2.15 kg (4 lb 12 oz) (National Anglers Council). The perch from the Serpentine, like the eels, proved extremely good to eat.

The perch were examined for parasites and particular attention was paid to the helminths of the gut, eyes and liver. Parasites from seven taxonomic groups comprising 11 species were found (Table 2). A more intensive microscopic study would undoubtedly reveal more protozoan parasites. Two of the gut helminths, the cestode *Proteocephalus percae* and the nematode *Camallanus lacustris*, were selected for more detailed examination (Lee 1973).

Protozoa: *Myxosoma mulleri* infested the gills of 16.3% of the perch. The mean intensity of infestation was 1.21 cysts/fish with a maximum of 52/fish and 20/gill. Fish of all ages were infested throughout the year.

Digenea: metacercaria of *Diplostomum spathaceum* were found in 25.9% of all perch and the mean intensity of infection was 0.73 worms/fish. There was a marked seasonality of this parasite which was absent from the perch throughout the summer and invaded the host again in October. One year old perch were most heavily infected (1.02 worms/fish) and older specimens showed increasing immunity to the parasite. The level of infection in Serpentine perch by this parasite was low and in no single fish was the infection sufficiently severe to cause blindness.

The other strigeid metacercarian found in the eye of the perch was *Tylodelphys clavata*. In contrast to *D. spathaceum* which occurred in the lens, this worm was always found in the vitreous humour of the eye. It was found throughout the year in 14.2% of the perch and in all age groups. Infections were usually light, the mean intensity of infection was 1.42 worms/fish but as many as 53 worms were recovered from a single host.

Adults of *Rhipidocotyle illense* were found in the rectum, and on rare occasions, the distal quarter of the intestine of 5.3% of the perch. Infections were light, averaging 0.35 worms/fish, and rarely more than four or five worms. Fish shorter than 15.4 cm were never infected with this parasite. Metacercaria of *R. illense* are parasitic on the gills, fins, eyes and subcutaneous tissue of various fish species especially cyprinids (Bykhovskaya-Pavlovskaya *et al.* 1964). Thus it would not be acquired in its adult form by the perch until the latter had assumed piscivorous feeding habits.

Cestoda: adult worms of *Proteocephalus percae* were found in the alimentary tract of 40·3% of the perch with a mean intensity of infection of 1·46 worms/fish. The incidence and intensity of infection increased with host age: 34·0% of 1+ perch were infected with a mean of 0·70 worms/fish and these levels of infection increased steadily until 45·8% of the 5+ fish were infected with 2·63 worms/fish. There was a marked seasonality of occurrence of *P. percae*, the parasite being almost absent from the perch population from June to August. The new infection was acquired, by the fish eating cyclopoid copepods containing the infective plerocercoids, during the autumn and early winter; after reaching a peak level of infection in mid-winter the worms mature and are gradually voided by the host until the fish becomes virtually free of this parasite in summer.

The encysted plerocercoids of *Triaenophorus nodulosus* were found in the liver. This parasite was found in all age groups, except fry, and in all months of the year. The mean intensity of infection was 1·63 plerocercoids/fish and 50·1% of the perch were infected. Occasional heavy infections of 30 fibrous cysts per fish were found and such infections meant that very little residual liver tissue remained.

Nematoda: adult worms of *Camallanus lacustris* were found in the pyloric caeca and intestine throughout the year. In all 94·4% of the perch were infected with this nematode with a mean intensity of infection of 14·3 worms/fish. Older perch were more heavily infected with up to a maximum of 129 worms per fish in extreme cases. The encysted larvae of *Eustrongylides* (? *excisus*) were found in 8·4% of the perch within the body cavity and attached to the gut. Infections were low, averaging 0·23 worms/fish and a maximum of 11 worms/fish were found in a single perch. This nematode was found in all age groups but only from October to March.

Acanthocephala: during 1971, 28 of the perch (7·78%) were infected with *Acanthocephalus lucii*. In all 73 worms were recovered giving a mean intensity of infection of 0·14 worms/fish. There was no seasonal cycle of maturation or occurrence. *A. lucii* was always found in the third quarter of the intestine.

Crustacea: during the winter months *Argulus foliaceus* was found infecting the skin of the perch, particularly around the anus. The infestations were never more than four per fish, the incidence was 2·3% and the mean intensity of infection was only 0·04 parasites/fish. It is possible that this parasite is more prevalent than these figures suggest; being an ectoparasite, specimens are very likely to be lost on handling, on killing the host, on deep-freezing or simply during the jostling when seine nets are being drawn in.

Discussion

The Serpentine is an unusual habitat in that it has been isolated within an urban area for over a century. Despite this it has been a self-controlled and self-perpetuating ecosystem for a long time. A more extensive limnological survey of the flora and invertebrate fauna would be interesting because it may reveal some abnormal distribution patterns: some species, common to lakes and ponds in southern England, may be absent, and conversely there may be relict species which have died out in less restricted waters. The main sources of immigration to the Serpentine must be by the agencies of birds or man. Although the Serpentine may be regarded as a specialised environment so can any other closed freshwater system and there is no reason to suggest that the ecosystem as a whole is anomalous. Truly natural aquatic environments must now be virtually unknown in southern Britain. That the Serpentine supports a relatively healthy, balanced flora and fauna indicates that it is a satisfactory subject for ecological study.

The most noticeable features of the fish fauna are that fish are abundant in the Serpentine and certain species, certainly the roach, tench and perch, grow to a large size. The species present are those which would be expected from a eutrophic lake in southern England. Two other possible inhabitants are the pike *Esox lucius* and the bream *Abramis brama*. In the absence of pike, perch are the main predatory fish, although eels, if present in large numbers, may also be important. The eel is a ubiquitous species that finds its way into almost every body of freshwater; it would be interesting to know if the Serpentine specimens have come from the lake in St James's Park, into which about 1,000 elvers were introduced in 1962 (Pentelow 1965). Goldfish are not common in the Serpentine, which suggests a recent introduction, perhaps from rejected pets or from the Round Pond in Kensington Gardens. The future of this species in the lake may be of biological significance.

The Serpentine fish were infected with 14 species of parasites; this compares with 19 fish parasite species found by Rizvi (Chubb 1970) in Rostherne Mere, Cheshire, which, like the Serpentine, is a small eutrophic water. If the fish species common to the two waters are compared, it is found that in Rostherne the perch and roach are infected with 17 parasites and in the Serpentine by 13. Thus, like the fish fauna itself, the parasite fauna is quite diverse. It should be stressed that parasites are not harmful to their hosts, but rather form an integral part of any animal's natural environment and that the host and parasite co-exist together in a state of dynamic balance (Hopkins 1959). Under certain conditions the parasite, by epizootic outbreaks, may control the host population (Watt 1968). With the possible exception of *Triaenophorus nodulosus* on occasions, none of the fish parasite species in the Serpentine adversely affected their hosts.

The final host of *Triaenophorus nodulosus*, which was common as the plerocercoid in perch, is the pike *Esox lucius* (Bauer 1962). No pike were caught in the Serpentine throughout the study period despite attempts to do so by angling and the use of gill nets in addition to the regularly used seine and trap nets. A small pike was seen in the Serpentine in the early 1950s and three or four small ones had been released into the lake just before that time but have presumably not survived (Wheeler pers. comm.). Therefore there appears to be no recent authenticated report of pike in the Serpentine. The definitive host of *T. nodulosus* in the lake is, therefore, unknown. The noticeably piscivorous and cannibalistic perch did not contain the adult worms although they were infected with the adults of the digenean *Rhipidocotyle illense* which is acquired by feeding on other fish, which are themselves the second intermediate host. Rawson (1952) suggests eels as an occasional definitive host of *T. nodulosus*, but the Serpentine eels do not appear to be infected. Any suggestions or information concerning the final host of this cestode in the Serpentine will be welcome.

The comparative abundance of different parasite groups varied appreciably. Parasites with direct life-cycles, i.e. those affecting only the fish and no other organism, were either Protozoa, monogenea, Crustacea or Mollusca and were, with the seasonal exception of molluscan glochidia, fairly rare. On the other hand, the commonest parasites belonged to the digenea, Cestoda or Nematoda—all of which have more than one host. This relative abundance is in marked contrast to that found by Wootten (1973) in Hanningfield Reservoir, Essex. The final or definitive hosts of all the Serpentine parasites are either fish or, as in the cases of the following, piscivorous birds: *Diplostomum spathaceum* in gulls, *Tylodelphys clavata* in grebes, *Ligula intestinalis* in gulls and *Eustrongylides* sp. in piscivorous birds (Bauer 1962, Bykhovskaya-Pavlovskaya *et al.* 1964, Hoffmann 1967). The fish themselves acquire the parasites from several sources: either passively as in the case of the Protozoa, monogenea, digenea (as metacercaria released by lymneid molluscs), Crustacea, molluscan glochidia and

Eustrongylides sp. or by feeding on infected intermediate hosts. The cestodes *L. intestinalis*, *Proteocephalus percae* and *T. nodulosus* and the nematode *Camallanus lacustris* are acquired by the fish fauna by feeding on infected planktonic crustacea, usually cyclopoids copepods. The only fish parasite in the Serpentine which has a life-cycle involving a host other than a mollusc, planktonic crustacean or bird is the relatively rare *Acanthocephalus lucii* which has the benthic isopod *Asellus aquaticus* as its intermediate host; this reflects the limited importance of benthic food in the diet of Serpentine fish. This is probably due to the muddy bottom and restricted littoral zone. Therefore, although the parasite fauna is diverse and in some groups abundant, it is not catholic in its host species and this may be indicative of a selective paucity in the Serpentine fauna.

Since the Serpentine is an isolated water, the parasites present were probably introduced with the original population or by birds. Even after an accidental introduction to a new habitat, a parasite's requirements are likely to be more complex than those of a free-living animal, because not only must the physio-chemical conditions be satisfactory but particular species of host(s) must be present in sufficient numbers for the life-cycle to be perpetuated. Characterisation of habitats by parasite fauna has been suggested by Wisniewski (1958) but this assumes that all potentially suitable parasites (and, for that matter, host species also) have had an equal opportunity to invade the habitat. However, the Serpentine is an isolated lake and chance introductions of any new fauna are probably rare. The parasites of the Serpentine fish must therefore be regarded as firstly, a function of those species fortuitously introduced and, only secondly, as a function of the character of the habitat.

The Serpentine has proved to be a fruitful subject for biological research. Although its position is unusual it does lend itself to easy and systematic sampling. It would be extremely interesting if more work could be done on the lake. The fish fauna is large enough and fertile enough to be studied more intensively and for a period of several years. The monitoring of population changes of both host and parasites would be valuable. Also a more thorough examination of the physio-chemistry of the water and a survey of the invertebrate fauna would be useful.

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Survey of Bookham Common:

THIRTY-FIFTH YEAR

Progress Report for 1976

General (G. Beven*)

It was a great loss to the survey when Armand Le Gros died suddenly on 1 March. Over many years he had helped and inspired the survey, not only with his extensive field knowledge of invertebrate natural history but also as a quiet and friendly companion who was popular with all. He was always ready to help beginners and to demonstrate his work at informal and other society meetings, and he was invaluable in committee. He will be sorely missed. On Bookham Common he studied fresh-water algae and numerous groups of invertebrates, publishing about 35 notes and papers of great interest including much original observation. The most noteworthy contributions were perhaps those on spiders (including their parasites), gall-mites and gall-midges. He also helped the survey by donating books and apparatus from time to time, and through the kindness of his cousin Mr M. H. Bournat many of his books and notes concerning Bookham Common have been given to the Society.

Mr B. M. Spooner again led the "Friends of Bookham Common" on a fungus foray on 24 October and recorded about 50 species.

If 1975 was notable for the long, dry and often hot summer extending into an exceptionally dry autumn, 1976 beat all records with another dry and hot summer. Between December 1975 and August 1976 only 122 mm of rain fell, 32 per cent of average at Kew (av. 1941-70=381 mm). Furthermore between April and August there fell only 82.1 mm of rain, the lowest cumulative total since records began in 1697. There were 1387 hours of sunshine between March and August, 129 per cent of average (av. 1941-70=1071), and in autumn the crops of acorns, haws, hips and sloes were exceptionally good.

Conservation Management (G. Beven*)

The southern end of the embankment of the Isle of Wight Pond has been fenced to prevent further erosion of soil. Work on coppicing in the north-east corner of Eastern Wood (ref. 616, 624) has been going on during the winter months since early 1975. Coppicing had not been done in this area since 1955. So far about 0.8 hectares have been cut. Sheepbell Pond has been cleared and opened up, much improving its appearance. Willow scrub has been removed from around Lower Eastern Pond, increasing the open water. Areas of grassland ref. 867, 854, 857 were swiped in early March and 0.8 hectares in other areas (ref. 841, 842) in October. Some timber has been felled in several small areas in southern parts of Central and Eastern Woods. The felling of the elms in Station Copse was completed during 1976. They had been killed by Dutch elm disease. Fortunately there were only two small fires during 1976, both before the extremely dry season, one (ref. 425) in Western Scrub in January and the other in early May on Eastern Plain.

Vegetation: Bryophytes (R. C. Stern†)

The following species are either new to Miss E. M. Hillman's list in *Lond. Nat.* 54: 49-58 (1975) or have been found in additional localities. The code for areas and habitats follows Miss Hillman's list.

* 16 Parkwood Avenue, Esher, Surrey.

† 50 Fordwater Gardens, Yapton, Arundel, West Sussex.

Mosses	Areas	Habitats	Remarks
<i>Fissidens bryoides</i> Hedw.	M	6b	
<i>F. exilis</i> Hedw.	M	2a	
<i>F. taxifolius</i> Hedw.	MQ	2a, 6b	
<i>Ceratodon purpureus</i> (Hedw.) Brid.	MQ	2a, 3	
<i>Dicranoweisia cirrata</i> (Hedw.) Lindb.	Q	7a	
<i>Barbula unguiculata</i> Hedw.	N	3	
<i>B. trifaria</i> (Hedw.) Mitt.	N	3	New record
<i>Grimmia pulvinata</i> (Hedw.) Sm.	MN	3	
<i>Pohlia nutans</i> (Hedw.) Lindb.	KNQ	6ab	
<i>P. delicatula</i> (Hedw.) Grout	Q	1c	New record
<i>Bryum bicolor</i> Dicks.	M	3	
<i>B. micro-erythrocarpum</i> C. Muell. & Kindb.	N	1b	
<i>Mnium hornum</i> Hedw.	Q	6b	
<i>Zygodon viridissimus</i> (Dicks.) R.Br.	Q	7a	Rediscovered by Bayfield Pond
<i>Orthotrichum diaphanum</i> Brid.	MN	3	New record
<i>Leptodictyum riparium</i> (Hedw.) Warnst.	PQS	1c	
<i>Amblystegium serpens</i> (Hedw.) B., S. & G.	M	3	
<i>Brachythecium rutabulum</i> (Hedw.) B., S. & G.	MQ	3, 6b	
<i>Pseudoscleropodium purum</i> (Hedw.) Fleisch.	M	5	
<i>Plagiothecium denticulatum</i> (Hedw.) B., S. & G.	NQ	7	
<i>Rhytidiadelphus squarrosus</i> (Hedw.) Warnst.	M	5	
Liverworts			
<i>Lunularia cruciata</i> (L.) Dum.	PQ	1c	See <i>Lond. Nat.</i> 55: 20 (1976)
<i>Riccia fluitans</i> L.	N	1e	Rediscovered in Up- per Eastern Pond
<i>Pellia endiviifolia</i> Dicks.	Q	1c	Bookham Stream; new record
<i>Metzgeria furcata</i> (L.) Dum.	KT	7	
<i>Lejeunea ulicina</i> (Tayl.) Tayl.	K	7	On <i>Acer campestre</i> ; new record

Insecta: Ephemeroptera (B. F. Arthure*)

The list of mayflies for the common is as follows:

Baetis rhodani (Pict.) Found in April 1976 in Central Ditch ref. 467. This species is not as common as *B. vernus/tenax*.

Baetis vernus (Curtis)/*B. tenax* (Eaton) Experts are apparently not agreed on the exact status of this insect, whether there are two distinct species or whether the distinction is ecological only. Larvae were found on 9 and 23 May 1976 and they appear to be fairly common in slow-moving water in Bookham Stream between ref. 577 and 424. On 23 May a few "spent" adults were found in the water.

* 145 Walm Lane, Willesden Green, London NW2.

Cloeon dipterum (L.) Common in Isle of Wight, Upper and Lower Eastern Ponds.

Ecdyonurus dispar (Curtis) On 23 May 1976 a single nymph was found in fast running water in Bookham Stream ref. 452. Elsewhere this species is common in fast stony rivers.

Paraleptophlebia submarginata (Stephens) This record is an old one, dated 1904, and we do not know of any being found subsequently.

Insecta: Lepidoptera (G. Beven)

The exceptionally dry warm summer was a good one for butterflies. White admirals *Limenitis camilla* were common from 23 June to 24 July when 30 or more were seen by Nigel Davies on a walk across the oak-wood. On 5 September Hugh Baillie found a fresh specimen which must have come from a second brood. There were 14 reports of purple emperor *Apatura iris* between 30 June and 7 August. Comma butterflies *Polygonia c-album* were seen from 20 March until 5 September when six on one bush were sipping juice from blackberries. Purple hairstreaks *Thecla quercus* were widely reported during July, and there were two white letter hairstreaks *Strymonidia w-album* on 2 July. A *valezina* form of the female silver-washed fritillary *Argynnis paphia* was seen by A. S. Wheeler in July.

Birds (G. Beven)

Population Studies in Oak-wood

The breeding season census was repeated in this 16 hectare sample of dense interior pedunculate oak-wood (Eastern Wood) in 1976. The population seems to have remained fairly stable.

Population Studies in Scrub and Grassland

The breeding season census was repeated in 39 hectares of scrub and grassland in 1976 (G. B. and W. D. Melliush). Changes in population have occurred in the following species, the figures being for 1974, 1975 and 1976 respectively. Increases were recorded in woodpigeon 6, 3, 8; turtle dove 10, 8, 13; great tit 16, 14, 18; blue tit 12, 9, 15; blackbird 18, 19, 22; nightingale 2, 2, 6; robin 25, 26, 32; garden warbler 5, 3, 8; whitethroat 13, 7, 15; lesser whitethroat 3, 4, 5; willow warbler 21, 24, 37. Decreases occurred in song thrush 19, 16, 15; greenfinch 2, 3, 1 (6 in 1971); linnet 1, 1, 0 (4 in 1967); redpoll 3, 1, 1 (6 in 1970); yellow bunting 5, 2, 2 (9 in 1966).

Breeding Habitat of Whitethroat and Lesser Whitethroat

W. D. Melliush has been looking into the habitat preferences of whitethroat *Sylvia communis* and lesser whitethroat *Sylvia curruca* on the scrub and grassland. During the period 1964 to 1974, there were 75 whitethroat and 16 lesser whitethroat territories on Western, Isle of Wight and Bayfield Plains in 25 hectares (61 acres). The territory areas could be roughly classified into two types of habitat: 1, mainly dense scrub with thickets, and 2, scrub with a few trees but including open grassy areas containing rank herbage. Of the whitethroat territories 19 (25%) were in habitat type 1, and 56 (75%) were in type 2. Of the lesser whitethroat territories 10 (63%) were in type 1 and 5 (31%) in type 2, with one in an intermediate type habitat. Thus here the whitethroat tends to choose scrub with grassy open spaces. The lesser whitethroat on the other hand seems to prefer dense scrub or thicket, but the number of territories is small and the differences may not be significant.

Other Notes on the Birds

A pair of coot hatched four young on the Isle of Wight Pond where a pair of mute swans produced four cygnets. In June, however, the water plants mysteriously disappeared and the cygnets began to starve. After one youngster was lost the remaining three weakened birds left the pond, following their parents on foot, being still unable to fly. There were reports of wrynecks in April, June and October (C. Mist and G. Whitehead). Gatherings of up to 30 magpies were noted in February (N. Davies). Parties of up to 20 siskins were feeding in Eastern Wood in February and March (Miss M. M. Taylor). On 11 January there were three hawfinches (ref. 452).

Mammals (G. Beven)

Of 29 rabbits *Oryctolagus cuniculus* killed in a shoot on 5 March, none were diseased, but on 1 September one was clearly dying of myxomatosis and at least 15 dead or dying rabbits were found subsequently. Previous epizootics of myxomatosis occurred in 1954, 1966 and 1974. A stoat *Mustela erminea* was seen carrying a wood-mouse *Apodemus sylvaticus* on 22 June (C. Mist). On 11 March by the Isle of Wight Pond Nigel Davies observed a charcoal grey weasel *Mustela nivalis* approach a small rabbit, which after screaming in the undergrowth staggered in circles until, obviously confused, it fell into the pond where it swam round until it drowned only five metres from the edge. All this time the weasel remained quite still in the undergrowth, perhaps scared by the observer, who then examined the dead rabbit but could find no sign of injury. Badgers *Meles meles* were reported in Lady Chewton's Wood in 1975 (C. Mist). There were at least seven sightings or foot print records of roe-deer *Capreolus capreolus* during the year.

Coleoptera of Bookham Common: Hydradeephaga

by D. G. HALL*

This paper is a continuation of a series started by Dr A. M. Easton over 30 years ago, the references to which are cited by Beven (1968). These, with the addition of some unpublished records by D. G. Hall, who collected somewhat irregularly between 1949 and 1957, revise the list of Hydradeephaga recorded on the common.

The Hydradeephaga are confined to water but not all beetles associated with an aquatic environment are grouped with them. The tendency is to regard in this group ground beetles that have adapted themselves to life in water. Kloet & Hincks (1977) do not use the division Hydradeephaga.

Coulson (1942) dealt with captures made before the Second World War when the common presented a different picture from today. The ponds still exist, but whether they are now so productive is something that research workers could usefully investigate. It is known that they have been drained from time to time. Coulson (1942) stated that from early April to September aquatic beetles abound. Altogether 31 per cent of the British list of Hydradeephaga have been found at some time on the common. As many of the records are now over 40 years old there is plenty of scope for rediscovering species and for finding new ones in the ponds and ditches.

Whilst it is not possible to emulate the standard set by Dr Easton, the month of capture is stated wherever it is known. Apart from records from gun-pits in 1945/46 (Payne & Castell 1955) and a couple of records definitely from Lower Eastern Pond, no information exists about the pond or ditch the species were taken from. Again there is plenty of scope for research in this direction.

The references are set out at this stage and only the reference number is quoted in the list that follows. Records made by the writer are indicated by DGH. SL after the date indicates that the capture was made on a field meeting of the South London Entomological and Natural History Society referred to in (1) below.

1. BEVEN, G. 1968. Twenty-five years of the Bookham Common survey, including a note on the increase of scrub on grassland. *Lond. Nat.* 47: 95–102.†
2. COULSON, F. J. 1942. The Coleoptera of Bookham Common. *Proc. S. Lond. ent. nat. Hist. Soc.* 1941–42: 51–61.
3. PAYNE, L. G. 1945. Coleoptera of Bookham Common: some extracts from my notebook, 1943. *Lond. Nat.* 24: 31–35.
4. PAYNE, L. G. & CASTELL, C. P. 1955. The beetles of the gun-pits (1945–1946). *Lond. Nat.* 34: 21–22.

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† The following amendments to the dates of three of the field meetings quoted by Beven (1968: 102) need to be noted: 4.4.04 should read 4.6.04, 24.4.39 should read 22.4.39, and 15.7.53 should read 15.8.53.

The nomenclature is according to KLOET, G. S. & HINCKS, W.D. 1977. *A Check List of British Insects*. Ed. 2. Part 3: Coleoptera and Strepsiptera. [*Handbk Ident. Br. Insects* 11 (3)]. Citations in the 1945 edition which differ in any way are placed in square brackets.

HALIPLIDAE

- Haliplus confinis* Stephens (2)
H. flavicollis Sturm (2)
H. fulvus (Fabricius) (2)
H. heydeni Wehncke (2)
H. immaculatus Gerhardt (2)
H. lineatocollis (Marsham) vii 35 SL
H. obliquus (Fabricius) (2)
H. ruficollis (Degeer) iv 39 SL
H. wehncke Gerhardt (2)

HYGROBIIDAE

- Hygrobia herrmanni* (Fabricius) [*hermanni*] iv 39 SL and x 46 (4)

NOTERIDAE [DYTISCIDAE auct. partim]

- Noterus clavicornis* (Degeer) [*capricornis* (Herbst)] (2)

DYTISCIDAE

- Laccophilus hyalinus* (Degeer) vi 46 (4)
L. minutus (Linnaeus) iv 39 and viii 53 SL and v 46 (4)
Hyphydrus ovatus (Linnaeus) iv 53 DGH
Hygrotus inaequalis (Fabricius) (2)
Coelambus [*Hygrotus*] *impressopunctatus* (Schaller) v 46 (4)
Hydroporus angustatus Sturm viii 53 SL
H. erythrocephalus (Linnaeus) iv 53 DGH
H. gyllenhali [*i*] Schiödte iv 53 DGH
H. memnonius Nicolai (2)
H. nigrita (Fabricius) ii 46 (4)
H. palustris (Linnaeus) iv 53 DGH and viii 53 SL
H. planus (Fabricius) ii, vi and xi 46 and i 52 (4)
H. pubescens (Gyllenhal) vi and x 46 (4)
H. tessellatus Drapiez (2)
Graptodytes [*Hydroporus*] *pictus* (Fabricius) (2)
Porhydrus [*Hydroporus*] *lineatus* (Fabricius) vii 35 and viii 53 SL
Copelatus haemorrhoidalis (Fabricius) (= *C. agilis* (Fabricius)) iv 53 DGH
Agabus bipustulatus (Linnaeus) ii and xi 46 (4) viii 53 SL, i 49 (Lower Eastern Pond) and vii 56 DGH
A. chalconatus (Panzer) vii 43 (Lower Eastern Pond) (3) vi, x and xi 46 (4) v 49 and iv 53 DGH
A. didymus (Olivier) (2)
A. guttatus (Paykull) v 45 (4)
A. nebulosus (Forster) ix 45 (4)
A. sturmi [*i*] (Gyllenhal) (2)
Ilybius ater (Degeer) viii 53 SL
I. fuliginosus (Fabricius) v 45, v and vi 46 (4)
I. quadriguttatus (Lacordaire & Boisduval) (= *I. obscurus* (Marsham)) (2)
Rhantus bistriatus (Bergstraesser) (2)
R. exsoletus (Forster) iv 53 and vii 56 DGH
Colymbetes fuscus (Linnaeus) x 46 (4)
Hydaticus seminiger (Degeer) iv 53 DGH and viii 53 SL
Dytiscus marginalis Linnaeus iii and x 46 (4)
D. semisulcatus Müller, O. F. iii 46 (4)

GYRINIDAE

- Gyrinus natator* (Linnaeus) vii 56 DGH
G. [natator v.] substriatus Stephens iii 45 and vi 46 (4)

A Working List of the Microlepidoptera of Bookham Common

by A. E. LE GROST†

This list of the microlepidoptera of Bookham Common is based on records extracted from the *Proc. Trans. Br. ent. nat. Hist. Soc.* 1902-1972, indicated as “(Proc.)” below, and others sent in by the following:

AME	A. M. Emmet	HGT	H. G. Tunstall
ASW	A. S. Wheeler	RWJU	R. W. J. Uffen
FMS	F. M. Struthers	WHS	W. H. Spreadbury

A few have been recorded by the compiler.

The nomenclature follows G. S. Kloet & W. D. Hincks’ *A Check List of British Insects* Ed. 2, part 2 (1972). References to L. T. Ford’s *A Guide to the Smaller British Lepidoptera* (1949) and its supplement (1958) are given in brackets.

NEPTICULIDAE

1. *Stigmella ulmivora* (Fologne) (Ford No. 1305)
“On elm near the station” 21 September 1969 (Proc.).
2. *Nepticula aurella* (Fabricius) (Ford No. 1295)
The silvery mines on *Rubus* sp. were a common and conspicuous sight in the winter of 1972-73.
3. *Nepticula marginicolella* Stainton (Ford No. 1307)
“On elm near the station” 21 September 1969 (Proc.).
4. *Nepticula acetosae* Stainton (Ford No. 1303)
1948, 1962 (Proc.). AME says that he found it in 1966 having been taken there by S. Wakely. He failed to find it in October 1971 as the area had been mown.

INCURVARIIDAE

5. *Nemophora degeerella* (Linnaeus) (Ford No. 1264)
“I have found one only 6.6.57” (WHS).
6. *Adela reamurella* (Linnaeus) (Ford No. 1266)
“Abundant most years” (WHS). “Seen plentifully and two caught 20.4.61, also seen plentifully 15.5.62”. (ASW).
7. *Adela rufimitrella* (Scopoli) (Ford No. 1268)
“I have no note of this but I have a distinct recollection of seeing a swarm round a clump of *Cardamine* by the ditch near Hundred Pound Bridge” (WHS).

PSYCHIDAE

8. *Taleporia pseudobombycella* (Hübner) (Ford No. 1240)
“The cases very numerous on holly boles near Hundred Pound Bridge” (WHS).

LYONETIDAE

9. *Leucoptera lotella* (Stainton) (Ford No. 1166)
FMS. 1948, 1958 (Proc.).

† Deceased; an obituary appears in this issue.

10. *Lyonetia clerkella* (Linnaeus) (Ford No. 1169)
FMS. 1949 (*Proc.*).
11. *Bedellia somnulentella* (Zeller) (Ford No. 1170)
"On *Calystegia*" 21 September 1969 (*Proc.*).

GRACILIARIIDAE

12. *Caloptilia alchimiella* (Scopoli) (Ford No. 1115)
1935 (*Proc.*).
13. *Caloptilia stigmatella* (Fabricius) (Ford No. 1116)
FMS. 1953; "Larvae were on white poplar where the road bridge crosses the railway" 1962 (*Proc.*).
14. *Acrocercops brongniardella* (Fabricius) (Ford No. 1095)
"Empty communal mines on oak" 21 September 1969 (*Proc.*).
15. *Phyllonorycter emberizaepenella* (Bouché) (Ford No. 1077)
FMS. 1957 (*Proc.*).
16. *Phyllonorycter trifasciella* (Haworth) (Ford No. 1076)
FMS. 1960 (*Proc.*).
17. *Phyllonorycter tristrigella* (Haworth) (Ford No. 1079)
"Mine with cocoon" 21 September 1969 (*Proc.*).

GLYPHIPTERIGIDAE

18. *Anthophila fabriciana* (Linnaeus) (Ford No. 839)
Recorded as *Simaethis fabriciana* at flowers of *Calystegia sepium* and *Sonchus arvensis*, Central Plain August–September 1969. *Lond. Nat.* 49: 100 (1970)).

YPONOMEUTIDAE

19. *Argyresthia curvella* (Linnaeus)
FMS. 1957 (*Proc.*).
20. *Scythropia crataegella* (Linnaeus)
July 1957 (WHS).
21. *Ypsolopha mucronella* (Scopoli)
FMS. 1956 (*Proc.*).
22. *Ypsolopha nemorella* (Linnaeus)
19–20 June 1957 (HGT).
23. *Ypsolopha dentella* (Fabricius)
1935 (*Proc.*).
24. *Ypsolopha parenthesella* (Linnaeus)
11 July 1956, 13 August 1956 (HGT).
25. *Ypsolopha sequella* (Clerck)
FMS. 1949 (*Proc.*).
26. *Plutella xylostella* (Linnaeus)
14 May 1957 (HGT).
27. *Orthotaella sparganella* (Thunberg)
1949 (*Proc.*). FMS. "Large pupae in borings in pith of leaf bases of *Sparganium* 12/71 West Hollow" (RWJU).
28. *Digitivalva pulicariae* (Klimesch)
"Noted with *Coleophora conyzae*" (RWJU).
29. *Acrolepia pygmeana* (Haworth)
"On *S. dulcamara* Isle of Wight Ditch" (RWJU).

EPERMENIIDAE

30. *Epermenia illigerella* (Hübner)
On *Angelica* 1951 (*Proc.*).
31. *Epermenia chaerophyllella* (Goeze)
On *Angelica* 1962 (*Proc.*).

COLEOPHORIDAE

32. *Coleophora lutipennella* (Zeller)
In numbers on oak but local 1904 (*Proc.*).
33. *Coleophora siccifolia* Stainton
"Three tiny cases were found peppering the leaves of a hawthorn on a woodland ride with tiny mines or already spun to its twigs for the winter". 21 September 1969 (*Proc.*).
34. *Coleophora gryphipennella* (Hübner)
A few on rose 1904 (*Proc.*).
35. *Coleophora serratella* (Linnaeus)
Very general on various trees and shrubs 1904 (*Proc.*).
36. *Coleophora viminetella* Zeller
"A few cases on willow Central Plain and sallow Hollow Path 1959" (RWJU).
37. *Coleophora potentillae* Elisha
"Case R. Fairclough. No date" (RWJU).
38. *Coleophora conyzae* Zeller
"Cases abundant in May 1958 on *Pulicaria dysenterica* on the important colony on Bayfield Plain at the corner of the road and Isle of Wight Road 845" (RWJU).
39. *Coleophora lineolea* (Haworth)
"Cases common on *Stellaria graminea* seedheads on the plains c. 1960" (RWJU).
40. *Coleophora genistae* Stainton
"In vast numbers on *Genista anglica* 1904, common 1927 and seen 1938, 1952, 1956" (*Proc.*). FMS. "Many cases on needle whin" (WHS).
41. *Coleophora discordella* Zeller
1958 (*Proc.*).
42. *Coleophora troglodytella* (Duponchel)
On *Pulicaria dysenterica* and *Achillea* 1956 (*Proc.*). FMS.
43. *Coleophora peribenanderi* (Toll)
"Case on *Cirsium arvense* c. 1960" (RWJU).
44. *Coleophora paripennella* Zeller
"Very few cases on *Centaurea nigra* 1959-60" (RWJU).
45. *Coleophora argentula* (Stephens)
"On my 1966 visit I found *C. argentula* on sneezewort (*Achillea ptarmica*), the usual food plant being yarrow (*A. millefolium*) and bred a moth" (AME).

ELACHISTIDAE

46. *Elachista megerlella* (Hübner)
FMS. 1952 (*Proc.*).

OECOPHORIDAE

47. *Batia lunaria* (Haworth)
1935 (*Proc.*).
48. *Diurnea fagella* (Denis & Schiffermüller)
"Common enough. The caterpillar with the Charlie Chaplin feet all too frequent when beating willows, etc." (WHS). On oak 21 September 1969 (*Proc.*).
49. *Agonopterix ciliella* (Stainton)
FMS. On *Angelica* 1957 (*Proc.*).
50. *Agonopterix alstroemeriana* (Clerck)
FMS. "I believe S. Wakely found these on a South London field meeting" (WHS).
51. *Agonopterix angelicella* (Hübner)
FMS. 1956 (*Proc.*).

GELECHIIDAE

52. *Isophrictis striatella* (Denis & Schiffermüller)
"In *Achillea ptarmica* heads beside the main path from the station" 21 September 1969 (*Proc.*).
53. *Recurvaria leucateella* (Clerck)
1935 (*Proc.*).
54. *Caryocolum tricolorella* (Haworth)
FMS. 1960 (*Proc.*).
55. *Brachmia rufescens* (Haworth)
FMS. 1957 (*Proc.*).

MOMPHIDAE

56. *Mompha locupletella* (Denis & Schiffermüller)
FMS.
57. *Mompha divisella* Herrich-Schäffer
FMS.

TORTRICIDAE

58. *Pammene argyrana* (Hübner)
"Reported by Messrs Attwood and Wakely" 1939 (*Proc.*).
59. *Eucosma hohenwartiana* (Denis & Schiffermüller)
FMS. 1957 (*Proc.*).
60. *Epiblema scutulana* (Denis & Schiffermüller)
FMS. 9 June 1956 (HGT).
61. *Zeiraphera insertana* (Fabricius)
FMS.
62. *Epinotia tetraquatana* (Haworth)
The gall was reported from *Betula* by H. J. Burkill (*Lond. Nat.* 25: 65 (1946)).
63. *Ancylis achatana* (Denis & Schiffermüller)
1935 (*Proc.*).
64. *Lobesia abscisana* (Doubleday)
Not uncommon in the tops of *Cirsium arvense* 1952 (*Proc.*).
65. *Endothenia gentianaeana* (Hübner)
"In the pith of *Dipsacus fullorum* heads Bookham Stream, 48, 73, December 1971" (RWJU).
66. *Apotomis betuletana* (Haworth)
15 June 1957 (HGT).
67. *Hedya nubiferana* (Haworth)
FMS.
68. *Pandemis cerasana* (Hübner)
16 July 1938 (HGT).
69. *Pandemis heparana* (Denis & Schiffermüller)
1935 (*Proc.*).
70. *Clepsis spectrana* (Treitschke)
"In shoots of *Epilobium hirsutum* Central Ditch c. 1960" (RWJU).
71. *Ditula angustiorana* (Haworth)
1935 (*Proc.*).
72. *Tortricodes alternella* (Denis & Schiffermüller)
23 March 1944 (WHS).
73. *Neosphaleroptera nubilans* (Hübner)
1935 (*Proc.*).
74. *Aleimma loeflingiana* (Linnaeus)
FMS. 1935, 1957 (*Proc.*).

75. *Tortrix viridana* (Linnaeus)
FMS. Swarms most years. (WHS). 1904 (Proc). "every beating operation produced a cloud" 1952 (Proc.).
76. *Croesia bergmanniana* (Linnaeus)
1935 (Proc.).
77. *Acleris tripunctana* (Hübner)
FMS. 1935 (Proc.).
78. *Acleris boscana* (Fabricius)
FMS. 1958, 1962 (Proc.).
79. *Acleris hastiana* (Linnaeus)
1949 (Proc.).
80. *Acleris emargana* (Fabricius)
28 August 1936, 15 October 1938 (HGT).

COCHYLIDAE

81. *Phtheochroa rugosana* (Hübner)
1951 (Proc.).
82. *Cochylis roseana* (Haworth)
"In seeds of *Dipsacus fullonum* 48, 73 in December 1971 by Bookham Stream" (RWJU).

PYRALIDAE

83. *Scoparia arundinata* (Thunberg)
1935 (Proc.).
84. *Nymphula nymphaeata* (Linnaeus)
FMS. 13 July 1957 (HGT).
85. *Cataclysta lemnata* (Linnaeus)
FMS. "abundant" (WHS).
86. *Ebulea crocealis* (Hübner)
1935 (Proc.) 13 July 1957 (HGT).
87. *Udea lutealis* (Hübner)
FMS. 13 Aug 1954, 13 July 1957 (HGT). One caught 9 July 1971 (ASW).
88. *Eurhodope advenella* (Zincken)
Larvae collected and reared July 1957 (WHS).

PTEROPHORIDAE

89. *Platyptilia calodactyla* (Denis & Schiffermüller)
Frequent (WHS). "85, common Central Plain 1960-61" (RWJU).
90. *Platyptilia pallidactyla* (Haworth)
1956 plentiful, 1957 (Proc.). FMS.
91. *Pterophorus pentadactyla* (Linnaeus)
"One caught 5 July 1962, confirmed M. Shaffer" (ASW).

Conservation in the London Area 1976

by ANNE MCCORD*

The London Nature Conservation Committee under the chairmanship of Mrs L. M. P. Small continued with its efforts to protect the interests of conservation in the London Area during the past year. The committee is composed of people whose conservation interests cover a wide range. Several have an interest and considerable expertise in a specialised field of natural history, such as botany or ornithology, while others have a special knowledge of a particular area of London. They are prepared to tackle the problems which the committee faces in a variety of ways. One week they may find themselves in the field, inspecting and reporting on a threatened area, and the next may be spent composing letters to members of local authorities to state the case for conservation. There is, however, one attribute which makes for an outstanding committee member. This is the ability to discover at an early stage any proposals which threaten to diminish the quality of the environment. London changes very quickly and with the vast quantities of paper that accompany each operation, it is often easy for an area to alter before anyone realises what is happening. If it is possible to put forward constructive proposals at an early stage, then the job of making suggestions and necessary alterations to plans becomes much easier.

The committee consists of twenty-one people at present and this is a small group to cover the whole of the society's area. But the society has nearly twelve hundred members and every one should have an interest in conservation. If this large group of people can watch out for possible threats to the environment, then the committee can get to work as soon as the matter is reported. Without conservation, future generations of the London Natural History Society may live in a poorer environment with few plants and animals to excite their curiosity and enrich their lives.

There are also small societies and groups in the area with interests in natural history and conservation, and the committee maintains links with them. Representatives from the Selborne Society, the Orpington Field Club, the Croydon Natural History and Scientific Society and the Wren Conservation Group serve as committee members. The committee is, in turn, represented on a number of bodies including the Council for Nature, the Colne Valley Committee, the Wandle Group and the Port of London Authority Committee on Conservation and Ecology. Each of the five county trusts within the area sends one representative to committee meetings to report on local problems. It is unfortunate that the Kent Trust is unable to find anyone at present willing to represent them on the LNCC. An observer from the Nature Conservancy Council provides advice when this is required.

The business of the committee is usually discussed in the order of the five vice-counties of London. Buckinghamshire provided very few problems during the past year as only a small part of the vice-county falls within the defined area. A total of twelve sites from Essex, eleven from Herts. and Middlesex, fifteen from Surrey and nine from Kent were all discussed and appropriate action taken.

A number of successes were recorded. Following representations to the local authority, Havering Park, Essex, was cleaned up and proposals were made to establish a nature trail and nature reserve. Some of the committee's work is only part of the total conservation effort. Letters were sent to the Department

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of the Environment about the choice of proposed routes of the M25 in Kent. The published plans show that all of the alternative routes suggested will spoil some very beautiful countryside and cut through several Sites of Special Scientific Interest. The LNCC, county trusts and many local bodies supported the choice of route which would do the least damage to the environment. But the Government does not see this as the obvious choice, as it is also the route which is most expensive to construct.

Many conservation problems continue for months or even years. Hampstead Heath is such an area. One difficulty may be solved but another soon takes its place because the heath is always under great pressure from a large number of people following a variety of activities. Orienteering is a sport which is comparatively new to this country but it is quickly growing in popularity. The S.E. Orienteering Association laid out a course on Hampstead Heath to attract new participants to the sport. Unfortunately they placed many of the points along the route in very vulnerable areas, mainly on marshy land and in clumps of willow where other visitors to the heath rarely penetrate. The result was considerable disturbance to wildlife. The LNCC have no right to state what other enthusiasts should or should not do on the heath, so a tactful approach was required. A meeting was arranged with a representative from the S.E. Orienteering Association. Suspicion of the committee's motives was expressed at first, but some success was achieved as plans were made for future co-operation which would preserve both interests. They included an agreement that no orienteering competitions would be held between 1 April and 31 August each year to prevent disturbance during the breeding season.

Not all areas are considered suitable for conservation measures and to attempt to conserve all sites, irrespective of their quality, would only serve to discredit the whole concept of conservation. A request was made to the committee to support a campaign for the establishment of a Local Nature Reserve at Lonsdale Road Reservoir, Barnes. The committee was unable to support the scheme as the site did not meet the standards laid down by law for a Local Nature Reserve. A survey was made of Abney Park Cemetery in Hackney but it was decided that there was not a strong case for its preservation as a conservation site. This does not detract from its amenity value but its future has passed out of the range of activities of this committee. It is hoped that a local group may be formed to concern itself with future plans for the cemetery. There are many 19th century cemeteries which are no longer required for burials, and a number have been preserved under the protection of groups established for this purpose. The most famous is the Friends of Highgate Cemetery who are involved in a long term project for the cleaning and maintenance of the cemetery. But there are smaller groups with similar functions and the committee is always pleased to give help and advice when required.

A problem found all over London is discarded fishing line. Festoons of nylon may be observed hanging from vegetation around many streams and ponds. Birds are unable to see the thin line, they swim or fly into it and become entangled. They are often killed or suffer appalling injuries as the line twists around their bodies and cuts off their circulation. The problem was very bad at Clapham Common and copies of the appropriate RSPCA poster were purchased and sent to the London Borough of Lambeth who arranged for them to be displayed at the ponds.

Members reported problems at Holland Park and grass cutting during the nesting season at the River Lee Reservoirs. Letters were written to the appropriate authority with satisfactory results. But it would be foolish to become too complacent because threats to the environment will continue, and the committee appeals to every member of the society to help.

Botanical Records for 1976

by R. M. BURTON*

In the future 1976 will be remembered as the year of the great drought. Already the preceding winter had been unusually dry, and from May to August hot, sunny weather was seldom interrupted. Cold spells had continued late into April, and spring seemed brief. Annual rainfall totals were set for a record low until heavy downpours in September came to bring back life to parched grass. Many observers have commented on the effect of the weather on species which cannot be relied on to form fruit every year; abundant seed was produced on *Fagus*, *Convolvulus arvensis* and others, but the failure of *Aesculus hippocastanum*, mentioned in the national press, was as keenly felt by London boys as others. It may be some years before the full effects of the heat and drought, and the consequent fires, on our vegetation can properly be assessed. Certain immediate results will, however, be mentioned at appropriate places in this report. At times the most direct effect of the excessive heat, with temperatures in the eighties day after day, must have been to discourage venturing out of the shade at all. In these conditions, it is surprising how many noteworthy records have been made, and it is possible to include here only a selection. For an explanation of the tetrad references attached to localities, e.g. (57T02), the reader is referred to Sandford (1972). Scientific names shown without their authors are taken from Dandy (1958).

V.C. 16, West Kent

On Dartford Heath (57T02) Mrs J. Pitt showed me *Vicia lathyroides*, last reported from the vice-county by F. J. Hanbury, also on Dartford Heath, in the 19th century. This had been seen there in 1975, at an excursion of the Orpington Field Club, but such a record needs to be properly vouched for, and there is now a specimen at the Maidstone Museum. The plants were on a sandy slope where a ditch had been dug to prevent cars from leaving a minor road, and it may be that this disturbance had brought long buried seed to near the surface. *Trifolium glomeratum* and *T. striatum* were in the same situation. Other interesting finds by Mrs Pitt include *Cyperus longus* in a branch of the River Darenth at Shoreham (56T20), *Geranium lucidum* by a road near Downe (46T20), a single plant of *Blechnum spicant* in enclosed ground at Keston (46T04), *Scutellaria minor* near the old fever hospital, Crofton Heath (46T26), *Hypericum montanum* in High Castle Wood, W. Kingsdown (56T62), *Verbascum lychnitis* x *thapsus* among its parents in a chalk quarry near Dunton Green (55T08) and *Cardamine amara* by a stream near Orpington (56T44). A specimen she sent me from the verge of a private road near Keston (46T24) was the New Zealand *Pratia angulata* Hook.f., related to *Lobelia*. The habit of the plant recalls *Cymbalaria* but the small white flowers have no spur and are followed by red berries. This creeping rockery plant is new to our records, though previous reference to its occurrence in the same place is made by McClintock (1960).

J. R. Palmer's usual interesting list begins with *Dracunculus vulgaris* Schott flowering by a lane far from houses in Swanscombe (67T02). This is occasionally grown in gardens as a curiosity, and the berries, like those of its relative *Arum maculatum*, are taken by birds. In Darenth Wood (57T60) he found vigorous flowering patches of *Viola reichenbachiana* x *riviniana*, and in the wild

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grounds of Mabledon Hospital *Aceras anthropophora* (57T60) and, established on a rough bank (57T62) *Vicia villosa*, which, differing in various respects from the plants occasionally reported under this name and *V. dasycarpa*, he refers to subsp. *eriocarpa* (Hausskn.) P. W. Ball. Similarly the flax found nearby (in 57T60) was similar to, but not identical with the native *Linum anglicum*, now reduced to a subspecies of *L. perenne* L., and he considers it should be placed in subsp. *montanum* (DC.) Ockendon, native in the Jura mountains of France and Switzerland. It is far from clear how this plant, noticed in the course of a Kent Field Club excursion, got to Darenth; if it is from horticultural seed it may not be an exact match for any of the wild subspecies. In a field west of Darenth Wood (57T62), Mr Palmer found *Valerianella dentata*, a rapidly decreasing weed in our area, and E. G. Philp found *Ajuga chamaepitys*. On a railway embankment at Swanscombe (67T04) Mr Palmer and Mr Philp found *Bromus benekenii**; this species has not previously figured in our records, although Dony (1967) shows it as occurring on the north-west fringe of our area, and a 1973 report of it in our part of Kent was published in *Watsonia* 10: 306 (1975). An artificial chalky bank on Swanscombe Marshes (67T04) was the unlikely habitat of *Astragalus glycyphyllos*, and further east at Rosherville (67T24) Mr Palmer found self-sown seedlings of *Sorbaria arborea* Schneid. On the rubbish tip on Crayford Marshes (57T26) he and E. J. Clement found *Ambrosia artemisiifolia*, *Ipomoea hederacea* Jacq., *Salvia reflexa* Hornem., *Setaria faberi* Herrmann, *Sida spinosa* L., *Urochloa panicoides* Beauv. and *Xanthium echinatum*. Some of these can certainly be associated with the local soya bean factory, and a few of them also appeared on the refuse tip filling a chalkpit at Stone (57T64), where a site for *Nardurus maritimus*, *Pyrola rotundifolia* and *Epipactis palustris* has been destroyed. This tip was visited by our meeting of 24 October, and produced *Amaranthus spinosus* L., *Ambrosia trifida* L., *Cleome spinosa* L., *Malva parviflora*, *Sicyos angulatus* L. and *Scorpiurus muricatus* L. among more common-place aliens and assorted indigenous plants such as *Lamium hybridum* and *Silene alba x dioica*. *Oxalis latifolia* here may have come in rubbish from gardens at Greenhithe (57T84) which it is over-running. A group of seedlings of *Ricinus communis* L. may indicate that the oil mill is processing castor oil seeds as well as soya beans. *Eleusine indica* Gaertn. also turned up in Mr Palmer's garden; he blames its presence there on a well-known and supposedly pure brand of proprietary manure.

In 1975 Mr Palmer found *Elodea nuttallii* in a ditch on Stone Marshes, identified by F. H. Perring. This alien waterweed has been found recently in many places where it had perhaps been confused with the previously familiar *E. canadensis*. It was seen in the River Medway below Tonbridge in the course of our meeting there in September, and Dr Perring has kindly sent me details of its discovery, by M. J. Andrews of the Thames Water Authority, in the new lake at Thamesmead (48T60).

In August M. Barber, Miss R. M. Hadden and myself visited a site near Thamesmead (48T40 and 48T60) which has been set aside as a nature study area by the Greater London Council. This was formerly part of the inaccessible ground in Woolwich Arsenal. The outlying buildings of the arsenal, now demolished, included several on raised mounds surrounded by moats, and two of these moats near the Thames form the principal interest of the study area. They are a lot further than the remainder from the original entrance to the arsenal, and it seems likely that the 1962 visit reported by Lousley (1963) did not penetrate this far, as the most remarkable of our 1976 botanical finds were not mentioned then. At the edge of the water of one of the moats a patch of *Juncus compressus* is perhaps the only instance of this rare rush in our part of Kent. The other one had several plants of *Samolus valerandi* at one extremity, a species not seen in the London Area for nearly 30 years, and at the other, single plants

* Note added in proof: This record is incorrect.

of *Ranunculus circinatus* and *R. trichophyllus*. The water between was choked with *Ceratophyllum submersum*. *Zannichellia*, *Myriophyllum spicatum* and *Rumex palustris* are further uncommon plants found on this site, which fortunately appears unaffected by drought and stands a reasonable chance of remaining unchanged for many years.

In Barnetts Wood, Shoreham (56T02), I saw an isolated colony of *Genista tinctoria* which is well-known to local residents, although I cannot find that it has ever been published. Near it were *Campanula trachelium*, *Carlina vulgaris*, *Lithospermum officinale* and *Rhinanthus minor*. One of the projected routes of the Swanley-Sevenoaks motorway would destroy this habitat. In Park Road, Beckenham (36T68), I saw mistletoe *Viscum album* high up in a street lime tree, where it can hardly have been planted. About 100 plants of *Orobanche minor* were found by P. Jupp in a field of red clover south of West Wickham (36T82), where the effect of the drought on the crop made the parasite more conspicuous. Mr Jupp also supplied lists of orchids and other plants found further south, filling important gaps in our records in an area which our botanists have rather tended to neglect in recent years; in 45T08 he found *Primula veris* x *vulgaris*. On a railway bank in Lewisham (37T64) Miss E. M. Hillman gathered a form of *Euphorbia uralensis*; in itself this is not very remarkable, but Miss Hillman points out that 140 years ago, in a chalkpit the face of which can still be seen a little way up the line near St John's Station, Daniel Cooper found a spurge which at that date could not be identified.

V.C. 17, Surrey

The most remarkable finds in our part of Surrey this year have been made by B. R. Radcliffe, to whom my thanks are due for assembling for me the records of a number of contributors. His account of an excellent new locality for *Cynoglossum germanicum* is published elsewhere in this issue. On Fairmile Common (16T02) he found our first Surrey record of the skunk cabbage *Lysichiton americanus* thoroughly established near the River Mole, in the company of *Caltha*, *Chrysosplenium oppositifolium* and *Carex paniculata*. In drier ground nearby *Corydalis claviculata* was very abundant, and *Adoxa* carpeted the low ground fringing the river. On Banstead Heath (25T24) Mr Radcliffe found a single suckering clump of the red chokeberry *Aronia arbutifolia* Pers. in woodland, which fruited abundantly. There does not appear to be a previous record of this shrub from eastern North America established outside gardens on this side of the Atlantic. Unfortunately it was later burned to the ground in one of the season's many heath fires. Also on Banstead Heath were several plants of *Acaena novae-zelandiae* Kirk on the side of an old gravel digging. At Cobham (16T00) he found a number of drought-stricken plants of *Onoclea sensibilis* in wet woodland, our first record of the sensitive fern. On Walton Common (06T84) Mr Radcliffe found nine plants of *Jasione montana*, probably where R. A. Boniface saw it in 1953. In Richmond Park (27T02) he found two plants of *Carex echinata*, a sedge seldom correctly recorded so close to London, where few suitably boggy habitats remain. His most surprising discovery was *Trifolium fragiferum* almost literally on his doorstep. Grassy suburban road verges are usually kept well mown, but in the summer of 1976 there was no growth of grass to mow, and the strawberry clover, which must have been present for many years unobserved, was allowed to flower. Further search showed it in a total of five tetrads in the Epsom and Banstead area (25T28 etc.), mostly on shallow chalky soil. On Tilburstow Hill he found a single clump of *Aruncus dioicus* (Walter) Fernald badly damaged by caterpillars in a wood (35T40); this was also seen on a golf course at Dulwich (37T42) by Miss R. Davis. It is not clear how this dioecious herb, allied to *Spiraea*, finds its way out of gardens.

In recent years *Epipactis palustris* has been known in Surrey as a single plant near Box Hill, but in 1976 R. A. R. Clarke found it at the edge of Oxted chalkpit (35T64); Mr Clarke says that he knew this orchid many years ago at the farthest edge of the pit. Almost as rare a plant is *Fumaria vaillantii* which he found on a nature reserve near Caterham (35T46), in disturbed soil on a chalky bank, close to the spot where it was found before the Second World War by A. Beadell; a single *Silene noctiflora* was nearby. In the same area in 1975 Mr Clarke collected *Rosa agrestis*, the identification of which has since been confirmed by R. Melville; without such confirmation the record of so rare a plant in a notoriously difficult group would not be acceptable. *R. agrestis* had not been seen in Surrey since 1944, nor in the London Area since the last century. In a chalky field at Sanderstead (36T20 and 36T40) Mr Clarke confirmed the presence of *Petroselinum segetum*; this may be the only place in Surrey where this decreasing species can now reliably be found. From a visit to Leigh Mill Pond, Godstone (35T60) by the Surrey Flora Committee in June, he showed me a specimen of *Potamogeton pusillus*.

Near Ham Gate on the west side of Richmond Park (17T80) Mrs S. Luce found three plants of *Scrophularia vernalis*. The source of this is a mystery; it was certainly not there 20 years ago when this area was thoroughly explored by Mrs B. Welch. By a disused reservoir at Barnes (27T06) she found *Medicago arabica* and *Valerianella locusta*. Her record of *Scirpus setaceus* is from Queen's Mere, Wimbledon Common (27T22); but her most remarkable records are from a grassy bank alongside a reservoir near Walton-on-Thames (16T28). There must previously have been calcareous grassland here, dependent on flooding by the chalk-laden Thames. *Filipendula vulgaris*, *Ononis repens*, *Poterium sanguisorba* and *Scabiosa columbaria* have long been known here as relics of those former conditions, and to these she has added a single plant of *Campanula glomerata*. Mrs Luce found *Briza maxima* at the foot of a wall near East Putney Station (27T44).

Early in the year Mrs L. M. P. Small and others found *Allium paradoxum* well established on a grassy bank near Richmond (17T66); this is likely to have escaped from Kew Gardens. In July they collected *Crassula helmsii* (T. Kirk) Cockayne in Baron's Pond, Epsom Common (25T08); this is one of many assorted aquatic plants used as oxygenators by the keepers of aquaria, who throw bits out when the plants become too prolific. Several patches were flowering freely on drying mud. Another plant which was assumed to be an escape from Kew Gardens is *Smyrniium perfoliatum* which turned up in a garden in Streatham Vale (27T80); the lady whose garden it is, and whose name I regret I have mislaid, told me that her daughter, who is employed at Kew, where the plant is abundantly naturalised, thinks she must have inadvertently brought seed of it home on her footwear. Mrs K. Lunnon found a single plant of *Lagurus ovatus* growing out of a neighbour's drain in East Molesey (16T48). Miss M. E. Young saw a single plant of *Anthriscus caucalis* near the A236 road crossing Mitcham Common (26T86); J. E. Lousley who knew the flora of this common so well never saw it there. Mrs E. Norman collected *Elodea nuttallii*, not mentioned in this paper for the first time, nor indeed for the last, in Pen Pond, Richmond Park (17T82), where it was flowering freely. On waste ground, formerly part of Surrey Docks (probably 38T40), Miss R. M. Hadden found a group of plants of *Apium graveolens*; it would be pleasing to think of this as a survival of a native species considered long extinct in Surrey, but it is more likely to originate from horticultural celery seed. Miss J. Willett noticed *Calamintha ascendens* close to her home at Epsom (25T08).

V.C. 18, South Essex

Quite the most remarkable discovery in our area this year was *Ludwigia palustris*, the subject of a separate publication elsewhere in this issue. This is

not the only rare plant whose appearance in the bed of a pond can be related to the weather. Later in the year J. O. Mountford found *Polygonum minus* among other *Polygonum* spp. in a totally dry pond at High Beach (49T06). K. C. Adams, who kindly communicated this discovery, follows Jermyn (1975) in stating that this species has not been reported in Essex since the publication of Gibson's flora of the county in 1862; they have overlooked four subsequent records by our members, the last in 1918. Dr Adams himself found a fallow field at Cranham (58T64) where the abundant *Vicia tetrasperma* was parasitised by about 80 plants of *Orobanche crenata* Forsk. This is a frequent pest of broad bean crops in Mediterranean countries, but does not seem to have been previously recorded in Britain. It is one of the more distinctive species in this difficult genus: the flowers are large with broad spreading crenate-denticulate lobes and a carnation scent, and are usually, as in this case, strikingly white with a delicate violet venation. The plant also occurred in plenty on a garden bean crop nearby in Upminster. Broomrapes have very light seeds, but it is not conceivable that *O. crenata* could have been brought directly by the wind from distant native populations without being more widely dispersed. It is more likely that both the 1976 colonies derive from a local source which has escaped notice.

Elodea nuttallii has also been found in our part of Essex; I gathered it in the Mar Dyke near Aveley (57T68) where it accompanied *Ceratophyllum demersum* and abundant *Lemna gibba*. This duckweed was also abundant in a ditch by Ferry Road, Rainham (58T00), and no doubt in other places where abnormal evaporation concentrated the nutrients in the water. I found *Geranium rotundifolium* in two places near Purfleet (57T48 and 57T68); this area is much more like the nearest part of Kent, where the species is less rare, than the remainder of Essex, where it is virtually unknown, and the same can be said of *Petroselinum segetum*, which I saw in the grounds of Thames Board Mills Ltd (57T48). A group of plants of *Cynosurus echinatus* which I spotted by the A13 in this area (57T68) may, I think, be in the same locality as all those mentioned by Jermyn (1975), although the place is referred to in three different ways.

Our meeting on 24 October visited the large refuse tip on Ripple Level, Barking (48T62), which is now regarded as filled to capacity. Among the less commonplace aliens seen were a fine specimen of *Urochloa panicoides* Beauv., *Momordica charantia* L. and a single *Amaranthus thunbergii* Moq., familiar to some of our members as a wool alien, but only our second record in the London Area, the other being in 1926. Several plants of *Chenopodium murale* were perhaps less surprising than the total absence from the tip of *C. rubrum*. However, plants growing on bare wet mud among tufts of *Puccinellia distans* by a brackish ditch east of the tip (48T82), forming a dense crop of seedlings not exceeding 5 cm in height, with all the leaves entire and small axillary inflorescences, proved to be a form of the red goosefoot.

H. E. Morgan and other members of the Wren Conservation Group have embarked on a very useful survey of the flora of Wanstead Park (mostly 48T06). Their most interesting find so far has been the grass vetchling *Lathyrus nissolia* by ornamental water. D. H. Kent, recording in Beckton Gas Works (48T40) for the Society's plant mapping scheme, found a large number of species in what might be considered an unpromising situation, including *Echium vulgare*.

V.C. 20, Herts.

Miss M. E. Kennedy is to be congratulated on the discovery of *Rumex maritimus* by the River Ver near Bricket Wood (10T20); it is quite new for this part of Herts. She found a patch of *Ornithogalum umbellatum* about 4 x 2 m in area by the river near North Mymms (20T22). In the River Gade at Watford (09T86) I. G. Smith collected *Elodea nuttallii*.

Our meeting of 25 April found a group of cleistogamous plants of *Lamium hybridum* on a roadside bank at Little Berkhamsted (20T88). Nearby a small pond was so completely covered by overwintered *Azolla filiculoides* that it appeared as though red material for surfacing a tennis-court had been spilled into it. A crumbling wall at Bayford House (30T06) had a colony of *Saxifraga tridactylites* which is not one of the few mentioned by Dony (1967), though it had been noticed previously by Miss Kennedy and P. C. Holland. Also in Bayford (30T08) were *Salix triandra* and *Menyanthes trifoliata*, the latter in the pond where Dony states that it is extinct. Our meeting of 19 September saw plentiful *Dipsacus pilosus* just on the boundary of our area at the edge of Easneye Park (31T82). Nearby in the River Ash were *Sagittaria sagitiifolia*, one plant of *Veronica catenata* among abundant *V. anagallis-aquatica*, and one of *Oenanthe fluviatilis*, which I regret having failed to recognise at the time.

On a building site at Mill End, Rickmansworth (09T44), Mr & Mrs Walker and independently of them Miss J. Colthup reported an unusual assemblage of alien plants, including *Abutilon theophrasti* Med., *Setaria faberi* Herrmann, *Solanum cornutum* Lam. and at least two species of *Ipomoea*. The species list suggests the dumping of waste material imported with soya beans. The site is less than 2 km from the factory at Springwell, Middlesex, where many plants accidentally introduced in this way were found nearly 30 years before by D. H. Kent and others.

V.C. 21, Middlesex

Centaureum pulchellum was known from Middlesex only as a single record by E. F. Shephard "near Staines" in 1896. This has now most gratifyingly been rediscovered near Staines (07T40) by Mrs J. E. Smith and Mrs S. Wenham, who found about 20 plants in what is most probably the same locality. Mrs Wenham also reported *Cynodon dactylon* near Staines bypass (07T40), and collected *Elodea nuttallii*, confirmed by J. H. Chandler, in Kempton Park (17T00) and Shortwood Common pond (07T40). In the latter locality *E. ernstae* St John (*E. callitrichoides* auct.) was reported in 1971, but had apparently disappeared. The new record and others call into doubt the accuracy of all our information concerning *E. ernstae* in Britain, specimens of which, some of them determined by H. St John himself, will need to be re-examined. *E. nuttallii* was also found in Brent Reservoir (28T06) by M. J. Andrews.

In May Miss M. E. Kennedy twice found *Saxifraga granulata* near Enfield (39T06 and 39T08), a long way from any previously known locality for the species. One place was the bank of a small reservoir, the other a cemetery, and it seems to me likely that in both the plant was accidentally introduced in turf. J. R. Phillips found *Ruscus aculeatus* in a small wood at Breakspeares (08T68). A. H. Gibson reported *Fumaria densiflora* at Wood Green (39T00), and this was confirmed by D. H. Kent, to whom I am indebted for communicating a number of these records. Mrs M. V. Marsden found several plants of *Carduus tenuiflorus* on a rubbish tip near Western Avenue, Northolt (08T84). In Hampton Court Park (16T48) Mrs S. Luce found *Datura stramonium* near the site of a manure heap of the previous year. In Hyde Park (28T60) J. R. Palmer found *Ambrosia artemisiifolia*, *Setaria lutescens* and other aliens near the Serpentine. D. McClintock collected a number of bird-seed aliens in the grounds of Buckingham Palace (27T88) including *Amaranthus retroflexus* and *Digitaria ciliaris* (Retz) Koel.

Our meeting of 29 July visited some of the small amount of still undeveloped land in the City remaining from the considerable acreage devastated in the last war. Almost nothing is left of the great variety of plant life listed by Salisbury (1945). In a small bomb-site in Jewry Street (38T20) there was a single plant

of *Ammi visnaga* Lam. among plentiful *Erysimum cheiranthoides*; the largest site remaining, in Lower Thames Street (38T20), had little of interest, though earlier in the year I had seen *Veronica filiformis* there. Gardens by the Tower of London (38T20) still produced abundant if very desiccated *Sisymbrium irio*; and nearby, on a parched lawn in Wakefield Gardens, a *Sonchus* of unfamiliar appearance, with deeply pinnatisect leaves and a dense white tomentum beneath the flower-heads, was later shown to be *S. tenerrimus* Desf., a common weed in Mediterranean countries. This, like the *Ammi*, must be presumed to have been introduced with birdseed, a quantity of which was found dropped nearby, though I can find no previous record of it having been imported in this way.

V.C. 19, North Essex; V.C. 24, Bucks.

No notable botanical discoveries have been reported in 1976 from those parts of these vice-counties which are not more than 32 km from St Paul's Cathedral, not even *Elodea nuttallii*.

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Armand Le Gros posing to collect spiders in a Salop garden in 1953.
Photograph: D. Arden.



Armand E. Le Gros

Obituaries

ARMAND EUGENE LE GROS, 1908-1976

Armand Le Gros died at his home in Catford on the 1 March 1976. He was born in the same road on the 22 March 1908, having moved only once—when three months old. Armand's grandmother came from near Caen in Normandy and his grandfather from Jersey. His father was killed during the First World War. He was brought up by his mother, an accomplished pianist who taught the pianoforte for a living. He began his education at Mountsfield School, Catford (named after Mountsfield, the home of H. T. Stainton the entomologist), then from the age of 11 he attended Dudley House School, Lee, which shut down when he was 16, and this was followed by private coaching up to matric standard. Armand had early ambitions to be an author. At about 20 years of age he and some friends formed a newsreporting agency, then around 1937 he entered the Civil Service with Royal Artillery Records at Foots Cray.

In 1942 he volunteered for service in the Royal Army Ordnance Corps and spent from then until demobilization in 1946 in the Middle and Far East where he attained the rank of sergeant. He then returned to the Record Office and in the same year joined the London Natural History Society. In 1947 he took the Civil Service establishment examination. Prior to 1946, however, Armand's natural history interests are a little obscure. The following passage is quoted from his nature journal: "Before the war I had a few letters and paragraphs published in *The Daily Telegraph* on literature and sport under the nom-de-plume of J. J. Adams—I cannot really understand why I did not use my own name. I only wrote on natural history when I joined the London N.H.S." We also learn that "as a boy I had a passion for writing lists". His cousin, Mr M. H. Bournat, recalls that he and Armand were frequently together from about 1926 onwards. They would turn over tiles and other objects to observe ants, and Armand also had a water spider *Argyroneta aquatica* with its air-bell. Another early concern was chemistry, but during one experiment Armand created a rather frightening explosion which terminated that interest.

Within a short while of joining our Society—"which meant so much to me later"—Armand was taking an active part in our affairs and was elected to the Entomology Committee. He led his first field meeting (an entomological one) on 2 May 1948 to Eynsford, and his notes tell us that "only Burkill turned up". In March 1949 his employment, then with the Royal Engineers, took him back to Egypt and, like the true naturalist that he was, he studied the natural history of his new environment until 1952, when he returned to this country to be stationed at Woolwich. Then, in 1956, his work took him to Kineton, Warwickshire, where he joined the two-year-old Warwick Natural History Society, and was elected to its committee. Whilst in Warwickshire Armand developed his interest in the tardigrades, or water-bears, on which he soon became an authority. In 1957 he returned again to the London area when he joined the Royal Armoured Corps Records at Chase Side Camp, Enfield, and from that date he maintained an unbroken interest in our activities. In January 1963 he suffered a stroke and in February 1964 his mother died. From then on he lived alone.

It is as an active London naturalist that we ourselves knew Armand. He was a true amateur of the highest order. His approach to his studies was professional (if that is the correct term). He corresponded widely at home and abroad. Much of his time was spent on advising others, especially beginners, and the writer is just one of many who will never forget his kindness and generosity. In many fields, especially spiders, the professionals sought his

advice on questions of biology and life-histories. On the Entomology, and later, Ecology Committees his advice was always well chosen and well received, and already he is very much missed. Over the years some of our field and indoor meetings have been affected by transport and power stoppages and consequently the attendances were poor, but Armand almost always turned up. He travelled by public transport and in one letter he describes the difficulty experienced, whilst not in good health, in getting from Lewisham to Bookham Common one weekday by bus during a 1973 rail strike. He was a staunch supporter of the Bookham Common Survey team and a valuable contributor to its reports. It is this area, together with north-west Kent, which occupied so much of his time. More is the pity that he could never be persuaded to join our Council, as he would undoubtedly have been a worthy member.

As is so often the case, it is only after someone dies that others who knew them realize how little they really did know below the surface. Armand Le Gros was no exception. For instance, in 1968 he was subscribing to forty societies and journals, mainly natural history, archaeological and historical, when he was obliged to cancel some for financial reasons. He had long been a subscriber to our reading circles, but in October 1975 he found the two ecological journals were getting not only too expensive to post on, but also "very difficult to appreciate the articles—if only they were written by the old Victorian naturalists". This remark, however, should not imply that he only liked the styles and contents of the older journals. Reading through his scientific correspondence this is clearly not the case. Likewise it is also apparent that he did not spare the expense if it resulted in benefits to his studies or the Society's programme. It is truly amazing that Armand managed to do as much as he did. If there was no competent specialist to hand he would knuckle down and study the group himself, be it plant or animal. He would condemn sending insects to the BM for naming. He once wrote "Do it yourself. The specialists there have enough on their plates already".

Apart from his natural history studies, and his nature journal already referred to, Armand kept a detailed diary of his activities from at least 1942. He also kept a detailed monthly list of his reading which, apart from natural history, covered such topics as philosophy, poetry, music, religion, war, literature, languages and the physical sciences. It was typical of him in that this list was completed (by typewriter) up till the end of February 1976, and the heading for March had been entered although he did not live to see that month.

We can best sum up Armand Le Gros by saying that we will miss his kindly advice and charming company. He has summed himself up in his own diary by asking "What will the reader of the future (some latter-day Le Gros) think of the compiler of this personal anthology. Will he be able to picture him from his comments. His liking for medieval history, presocratic philosophy, the history of the Channel Isles and of China, for insects and spiders, for epicureanism, his admiration for the life and work of Fabre and Darwin, Edward Wilson and Russell, his love of Montaigne, Chaucer and Jane Austen, of Haydn, Beethoven, Mozart, and Dvorak—his curiosity, his shyness, his devotion to his grandparents, his attempts to be intellectually honest, his sympathy for the frustrated, his hatred of pomposity, of the establishment".

It is through the kindness of Mr Bournat that the LNHS has been presented with Armand's natural history books, papers, diaries and notes, which include the material he had gathered together for a projected natural history of Lewisham and also a typescript on the microlepidoptera of Bookham Common. It is hoped the former can be suitably edited for publication; the latter appears in this volume.

K. H. HYATT

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K. H. HYATT

HERMAN SPOONER, 1878-1976

Herman Spooner, one of the Society's oldest Vice-presidents, died aged 98 on 23 November 1976 in north Wales, where he had lived since leaving London in 1955. One of the old school of good all-rounders, he was a valued member of the Archaeological, Botanical and Ramblers Sections and more recently of the Dyserth and District Field Club and the Prestatyn Horticultural Society of which he was a past-President.

He was born at Lawford, Essex, on 4 July 1878 and became a student gardener, first at the Royal Horticultural Society's gardens then at Chiswick and afterwards at Kew. Later he joined the Chelsea nursery of James Veitch as botanical assistant and it was during the firm's jubilee that he compiled the material for the unique volume, *Hortus Veitchii* (1906), a record of the many introductions of the firm from countries where it had sent collectors. His name is commemorated in *Clematis spooneri* Rehder & Wilson (1913), introduced from west China by E. H. Wilson for James Veitch. Wilson also sent the first seeds of *Davidia involucrata*, the handkerchief tree, to Spooner for distribution to other nurserymen. Most of his life, however, was spent as curator of the exhibition galleries at the Imperial Institute in South Kensington.

He joined the London Natural History Society in 1922, becoming a Vice-president eight years later. He was Chairman, first, of the Botanical Section from 1931 to 1937 and then of the Ramblers from 1947 to 1952. It was under his guidance that the latter expanded and continued the policy of its founder, as the general introductory section for new members joining the Society. Rambling was his great joy, and he climbed Snowdon when in his late eighties and never missed a daily walk.

Herman Spooner was a very cultured man of wide interests, including an appreciation of modern art, although his own sketch books contained traditional landscapes. He was a Fellow of the Royal Horticultural Society, a member of the Zoological Society of London, the Charles Lamb Society and a founder member of the Council for the Promotion of Field Studies. He was very kind, considerate and encouraging to the beginner and a delightful companion. Some of us will remember with pleasure the walks he led to Kew and Wisley and the visits to Lambeth Palace, the Tate Gallery and the Wallace Collection. We are grateful for those memories and the Society which made them possible.

ROSA DAVIS

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NOTICE

An obituary to Job Edward Lousley, 1907-1976, appeared in *Lond. Nat.* 55: 63-64 (1976).

at 31 October 1975

1974

Assets

21,931	Quoted Investments at cost (Market value £59,818)	..	..	..	..	..	59,764
Funds at Bank and on Deposit							
18,451	No. 1 deposit account	..	..	..	..	..	125
	No. 2 deposit account	..	..	..	..	..	3,018
							<hr/> 3,143
—	Cash capital	..	..	..	..	..	1,224
—	Cash income	..	..	..	..	..	227
							<hr/> 1,451
349	Current account	..	..	..	..	..	1,335
							<hr/> 5,929
9,412	United Dominions Trust	..	..	..	..	..	—
9,615	Central Investment Company	..	..	..	..	..	—

NOTE:

At 31 October 1975 claims were pending for repayment of income tax deductions and credits relevant to investment income received in income tax years to 5 April 1975. These amounted to £1,625 (net of custodians' charges £108).

Report of the Auditors to the
Members of the London Natural History Society

We have verified the accounts with the books and records of the Society and certify them to be in accordance therewith.

Knightway House,
20 Soho Square,
London W1V 6QJ
9 August 1976

NORTON KEEN & CO.,
Chartered Accountants

£59,758

£65,693

General

[illegible]

£5,510

£4,935

Publications

542	<i>Programme</i>	..	..	..	..	..	..	..	354
493	<i>London Naturalist 52</i> (Excess of expenditure over reserve)	..	..	..	..	..	..	..	—
1,750	<i>London Naturalist 54</i> reserve	..	..	..	..	..	..	..	1,500
120	<i>London Bird Report 38</i> (Excess of expenditure over reserve)	..	..	..	..	..	..	..	196
	(£1,196—£1,000)								
1,000	<i>London Bird Report 39</i> reserve	..	..	..	..	..	..	..	1,350
328	<i>Bulletin</i>	..	..	..	..	..	..	..	697

£4,233

£4,097

Account

1974	Receipts	
2,815	Subscriptions—current	2,857
26	arrears	15
82	advance	46
—	entrance fees	38
<hr/>		
2,923		2,956
72	Donations	34
145	Tax recovered from deeds of covenant	219
99	Deposit account interest (National Westminster Bank Ltd.)	59
190	Deposit account (Central Investment Co.) excluding premises fund	—
4	Sundries including bird film receipts	—
660	Dividends	—
223	Transfer from premises and equipment fund	22
—	Transfer from ornithological research fund	147
—	Transfer from library cataloguing fund	101
1,194	Excess of payments over receipts (transferred to accumulated fund)	1,397
<hr/>		
£5,510		£4,935

Account

198	Sale of publications	..	..	..	..	..	..	..	..	305
7	<i>Bulletin</i> income	..	..	..	..	..	..	..	..	11
4,028	Transfer from general account	..	..	..	..	..	..	..	..	3,219
—	<i>London Naturalist</i> 53 (excess reserve over expenditure) (£1,750—£1,188)					..	..	..	..	562
<hr/>										
£4,233										£4,097
<hr/>										

Statement of Affairs

1975

		Premises and Equipment Fund (incorporating the Hindson and Castell bequests)			
56,199		Balance at 1 November 1975			63,666
	1,176	Add: Bank deposit interest		223	
	1,735	Other deposit interest		73	
	1,055	Investment income received		2,789	
	—	Income tax recovered		1,625	
		(net of custodian's charges £108)			
	3,848	Adjustments for accumulations and profits and losses on disposals		57	
	7,814			4,767	
	325	Less: Custodian's charges		366	
7,489					4,401
63,688					68,067
22		Less: Grant to general account			196
63,666					67,871
		Life Composition Account			
200		Balance at 1 November 1975			200
		Other Reserves			
		Library cataloguing fund:			
99		Balance at 1 November 1975		99	
1,500		London Naturalist reserve		1,400	
1,350		London Bird Report reserve 39	1,350		
—		40	1,500		
				2,850	
		Plant mapping scheme: research and publication fund:			
275		Balance at 1 November 1975	275		
—		Less: Transfer to general account	6		
275				269	
3,224					4,618
		Accumulated Fund			
—		Balance, deficit, brought forward		(1,397)	
(1,397)		Deficit for year—general account		(938)	
(1,397)					(2,335)
£63,693					£70,354

at 31 October 1976

1975									
	Assets								
59,764	Quoted Investments at cost	..	..	..	..	..			64,516
	(Market value £53,765)								
	Funds at Bank and on Deposit								
125	No. 1 deposit account	..	..	..	..	..	1,500		
3,018	No. 2 deposit account	..	..	..	..	..	3,241		
								4,741	
1,224	Cash capital	..	..	..	..	..	866		
227	Cash income	..	..	..	..	..	11	877	
1,335	Current account	..	..	..	..	..		220	
5,929									5,838

NOTE:

At 31 October 1976 claims were pending for repayment of income tax deductions and credits relevant to investment income received in the year ended 5 April 1976. This amounted to £1,270.

Report of the Auditors to the
Members of the London Natural History Society

We have verified the accounts with the books and records of the Society and certify them to be in accordance therewith.

Knightway House,
20 Soho Square,
London W1V 6QJ
26 November 1976

NORTON KEEN & CO.,
Chartered Accountants

General

1975	Payments	
218	Hire of halls, etc.	512
—	Lecturers' fees and expenses	107
381	Sectional expenses including LNCC	298
82	Printing and stationery	400
265	Library	153
39	Castell research centre	20
265	Honoraria	340
166	Postage and telephone	181
1	Sundries	36
22	Equipment repairs and renewals	23
177	Cost of services (auditor's fees, bank charges, insurance, etc.)	256
100	Publicity	100
3,219	Grant to publications account	3,579
<hr/>		<hr/>
£4,935		£6,005

Publications

354	<i>Programme</i>	438
1,500	<i>London Naturalist 54 reserve</i>	—
—	<i>London Naturalist 55 reserve</i>	1,400
196	<i>London Bird Report 38 (excess of expenditure over reserve)</i>	—
1,350	<i>London Bird Report 39 (reserve brought forward £1,350—no expenditure during the year—reserve carried forward £1,350)</i>	—
—	<i>London Bird Report 40 reserve</i>	1,500
697	<i>Bulletin</i>	589
<hr/>		
£4,097		£3,927

Account

1975	Receipts	
2,857	Subscriptions—current	3,893
15	arrears	6
46	in advance	202
38	entrance fees	109
<hr/>		<hr/>
2,956		4,210
34	Donations	290
219	Tax recovered from deeds of covenant	321
59	Deposit account interest (National Westminster Bank Ltd.)	44
22	Transfer from premises and equipment fund	196
—	Transfer from plant mapping scheme	6
147	Transfer from ornithological research fund	—
101	Transfer from library cataloguing fund	—
1,397	Excess of payments over receipts (transferred to accumulated fund)	938
<hr/>		<hr/>
£4,935		£6,005

305	Sale of publications	..	..	..	..	..	..	..	..	198
11	<i>Bulletin</i> income	..	..	..	..	..	..	..	..	19
3,219	Transfer from general account	..	..	..	..	..	..	..	..	3,579
562	<i>London Naturalist</i> 53 (excess reserve over expenditure)					..	..	..	..	—
—	<i>London Naturalist</i> 54 (excess reserve over expenditure)					..	..	..	..	131
	(£1,500—£1,369)									
<hr/>										
£4,097										£3,927

Book Review

Flora of Surrey. By J. E. Lousley. 484 pp, 3 colour + 33 black and white plates, 504 species maps. David & Charles, Newton Abbot. 1976. £12.50.

Despite loss of much ground under the bricks and mortar of London, Surrey is still endowed with a wealth of flowering plants out of proportion to its modest size. An up to date flora of the county has been sorely needed for many years and this present volume admirably meets the need.

Opening chapters deal comprehensively with the physical aspects of Surrey, such as its boundaries both administrative and Watsonian, topography, climate, and geology (by Dr A. J. Stevens). Biographical notes on former botanists who have worked in the county, from William Turner to Donald Young, are of interest, as is an account of the circumstances culminating in the three floras dealing specifically with Surrey, of which this is the latest.

Chapters four and five, covering changes in the flowering plant distribution and conservation aspects, make fascinating reading. They reflect Ted Lousley's intimate knowledge and affection for his home county. There is a depressingly long list of extinctions, but it is heartening to be able to report the recent return of *Aster tripolium*, albeit in a somewhat precarious habitat. A chapter on distribution, supported by soil maps, will give the reader useful pointers on where to expect particular habitats and, indeed, where to look for particular species. This is followed by the main text covering Surrey's plants in systematic order, including also notes on the many casuals and aliens, not forgetting comments on extinctions and doubtful records.

The final section comprises 504 maps of selected species, again in systematic order. A number of black and white and several fine colour plates, including that on the dust jacket, enhance the quality of the publication.

Spelling errors, fortunately, are few although the frequent appearance of 'centrad' is irritating. The omission of three species, *Equisetum palustre*, *Hypericum hirsutum* and *Juncus bufonius*, is surely unintentional. Readers unfamiliar with the county should not assume that these common species are absent. The unfortunate transposition of the titles of *Epipactis leptochila* and *E. phyllanthes* on two of the colour photographs has been mentioned elsewhere.

The maps, which are the condensed result of many years field work on the part of the Surrey Flora Committee, have obviously been selected with care. Species have been omitted that are too common to warrant presentation in map form, rarities that are too disjunct to exhibit a recognisable pattern, and those whose existence might be endangered by the revelation of their localities. It would have been interesting to see more species mapped but presumably space and cost would not permit this action. The maps, though of small size, are clearly presented and easy to follow. A minor criticism is that both species name and map number are in rather small type requiring good illumination for comfortable reading.

No Surrey plant lover could consider his or her library adequate without a copy, and, because Surrey is a microcosm of most of the vegetational types of southern England, a much wider circle of readers would profit by its acquisition. The price is admittedly high, but the book is good value.

BRYAN RADCLIFFE

Regolith Overlay

by HERBERT A. SANDFORD*

This is the fourth in a series of overlays being produced to assist the study of the distribution of plant and animal species in the Society's Area. The project is described in *Lond. Nat.* **51**: 20-21 (1972). That issue contains a pocket for overlays and also the Annual Rainfall Overlay, while the Master Grid Overlay appeared in *Lond. Nat.* **52**: 155 (1973) and the Habitat Overlay in *Lond. Nat.* **54**: 72-73 (1975).

The nature of the soil is of prime importance to the distribution of many plants as well as certain land snails and other invertebrates. The more significant soil characteristics that vary over our area include texture and drainage, the degree of acidity or alkalinity and the depth and fluctuation of the water-table.

The only sheet of the *Soil Survey of Great Britain* so far published within our area is number 238, the Aylesbury sheet. This includes a small area around Abbots Langley near Watford. A number of other surveys have been made, and some published, but there is as yet no complete soil map for the Society's Area. Even when complete, this survey will be of limited use for our purposes as it excludes urban and other areas of disturbed ground which cover so much of our area.

There are some excellent floras for the Home Counties but their authors have found it necessary to infer the nature of the soils from the drift or surface geology, the new survey of which is now virtually complete. Jermyn provides a soil texture map (Jermyn 1975: map 15) but relies mainly upon a much larger scale and more detailed drift geology map folded into the back cover. Lousley (1976: 74-81) also has to rely upon drift geology for his maps, but he helpfully groups the geological outcrops, not by age and origin, but by lithology: gravels, clays, limestones and so forth.

In the absence of a completed soil survey our county floras have found it necessary to map the geological rocks that provide the 'parent material' of which the soils are partly formed. The present overlay aims at achieving a compromise between a geological map of limited value and a soil map which cannot yet be drawn. This is attempted by mapping the regolith. The author is indebted to Alice Coleman of King's College, London, for suggesting this name, though he alone is responsible for any errors of judgement contained in the map.

The regolith is the top of the Chalk, London Clay or other geological rock that has been weathered and out of which soil is formed. It is more or less what many gardeners would call "subsoil". The regolith is clearly related to the lithology of the rock beneath and determines in large measure the nature of the soil at its surface.

A calcareous regolith has been developed extensively on the Chalk, particularly in the North Downs. North of the Thames, and especially in Essex, much of the glacial 'Boulder' Clay has been found by Professor Keith Clayton of the University of East Anglia to be young enough to have retained some of its original chalk fragments close enough to the surface to be within the reach of such plants as traveller's joy *Clematis vitalba* L. The older glacial clays have lost their chalk by solution or leaching, and their regoliths have been grouped

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Instructions to Contributors

Submission of papers

Papers relevant to the natural history and archaeology of the London Area should be submitted to the editor, Mr J. R. Laundon, Department of Botany, British Museum (Natural History), Cromwell Road, London SW7 5BD, before the end of January if they are to be considered for publication in the same year. They should be typed, with double spacing and wide (three cm) margins, on one side of the paper. Authors must retain a duplicate copy. Papers should include at the beginning an abstract, summary or synopsis.

Text

Spellings are to follow *Chambers Twentieth Century Dictionary* 1972 edition; locality spellings should follow the latest editions of the maps published by the Ordnance Survey. Capitalisation should be kept to a minimum. Common names of animals and plants must begin with lower-case initials, and scientific names must be underlined. When both common and Latin names are given there should be no brackets or commas separating them. Genus names should appear in full where first used within each paragraph. In descriptive matter numbers under 10 should be in words, except in a strictly numerical context. Dates should follow the logical sequence of day, month, year (i.e. 25 December 1971). Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs or St. Lists should be in natural, alphabetical or numerical order.

References

Reference citation should be based on the Madison rules (in *Bull. Torrey bot. Club* 22: 130-132 (1895)) except that a colon should always precede a page number. Capitalisation in titles of papers in journals should be kept to a minimum. Journal titles should follow the abbreviations in the *World List of Scientific Periodicals* and be underlined. Examples are as follows:

In text:

Meadows (1970 : 80).

(Meadows 1970).

In references:

MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964-9. *Lond. Nat.* 49: 76-81.

MELLANBY, K. 1970. *Pesticides and Pollution*. Ed. 2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* 92: 39-45.

Illustrations

Distribution maps should be submitted in the form of a Recording Map with symbols in Indian ink or Letraset. Solid dots are used to indicate contemporary or recent presence, circles for old records and crosses (not pluses) for other information, such as introduced species. Tetrad dots and circles should be 4.0 mm and tetrad crosses 5.0 mm, with a line thickness of 0.8 mm; all monad symbols should be 1.6 mm with a line thickness of 0.5 mm. The legend should be written outside the frame of the map and will be set up by the printer. The Mapping Schemes Secretary can provide Recording Maps, advice and dies for printing distribution symbols.

Line drawings should be in Indian ink on Bristol board, preferably twice the printed size. Place names, etc., must be produced with stencils or Letraset. Legends should be separate as they will be set up by the printer.

Photographs should be glossy black-and-white prints, of good contrast, preferably half-plate in size.

Proofs

Galley proofs will be sent to authors for scrutiny, but only essential corrections can be made at that stage.

Reprints

Up to twenty-five free reprints will be supplied on request. Additional copies may be purchased if ordered when the proofs are returned.

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